# ea

# Electronics Australia

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## 40 PAGES of hardcore electronics

# WHO'S THE BOSE?

## INSIDE A $7000 DOLBY DIGITAL SOUND SYSTEM

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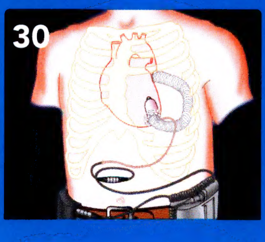

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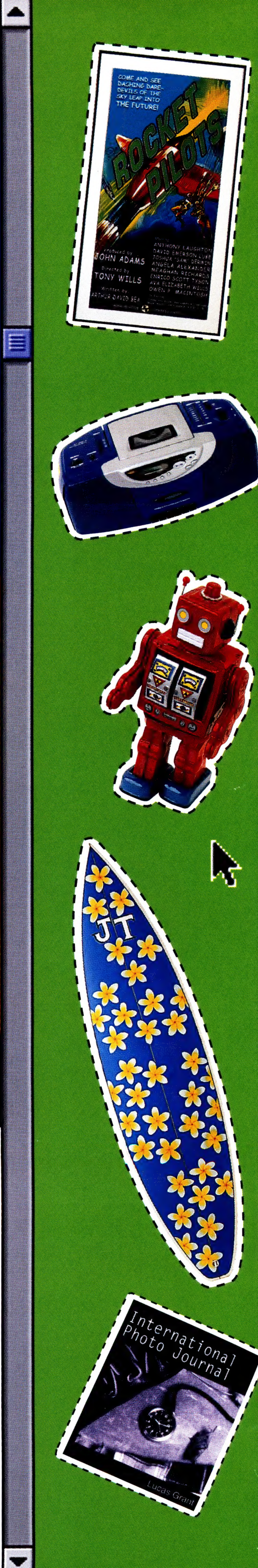
COME AND SEE DASHING DARE-DEVILS OF THE SKY LEAP INTO THE FUTURE!
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ea
ELECTRONICS AUSTRALIA MAGAZINE **VOL. 62, NO. 8**
AUGUST 2000

# FEATURES

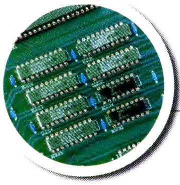
**Bose Lifestyle 50 . . . . . . . . . .18**
Bose go digital! Yes, their Lifestyle 50 offers full Dolby Digital surround sound, with a six-CD stacker and wireless remote, but you'll need deep pockets...

**Bionic Man . . . . . . . . . . . . . .30**
We have the technology, we can rebuild him... Why go on with old-fashioned internal organs, when you can upgrade to the latest models?

**Gameboy Programming – 2 . . .60**
Make your Gameboy work for you! With this simple interface card you can control practically anything.

**How it Works . . . . . . . . . . . . .68**
The first in a new series of articles covering everything from mobile phones and TVs, to how chips are made. This month, we look inside microwave ovens.

**Reader's Survey . . . . . . . . . . .98**
Help us to help you. This readers survey gives you the chance to have your say in EA. Fill it in and send it back to us – We want to know all about you!



# WHAT'S NEW

IN THE EVER CHANGING WORLD OF ELECTRONICS

### THIS MONTH

- JVC RX-7001PGD home theatre receivers
- Sony VAIO notebook PCs.
- Panasonic NV-FJ600A Super Longplay VCRs
- Marantz RC-2000MII Universal Remote Controller
- Philips FWR7, FWR8, Mini System with integrated CD recorder
- Electro-Harmonix 300B EH triode
- Panasonic CQ-DRX900 CD player/receiver with flip-out speaker
- JVC GR-DVL300 and GR-DVL100 compact digital-video cameras
- Panasonic GD30 dual-band mobile
- Clarion PRO-97V stereo headphones

# First in Australia: 12 hour VCRs

**PANASONIC** ensures you'll capture even the longest Olympic events on your TV – with its latest range of VCRs. The new models allow users to record up to 12 hours on a single E-240 (4-hour) cassette tape.

The VCR's Super Longplay mode has been engineered to slow the tape down so that very fine lines of information are recorded onto the tape, thus providing additional recording time.

Panasonic will release three Super Longplay VCRs through major retail outlets – the NV-FJ600A, the NV-SJ400A and the NV-SJ200A.

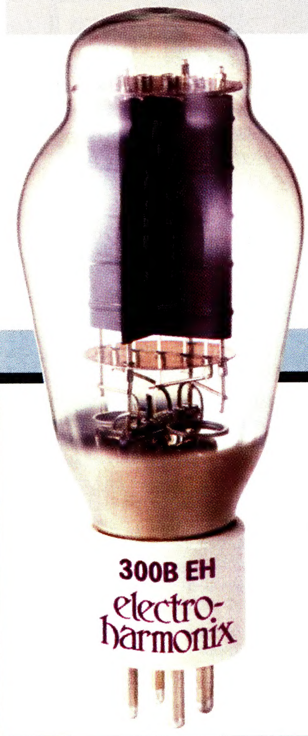
The new models offer 3 recording modes: Standard (4 hrs on 240min tape). Long Play (8 hrs on 240 min tape) and Super Longplay (12 hrs on 240 min tape). The VCRs not only offer industry-leading playing time, but are also designed for quick access, high-quality recording and easy set up.

Panasonic's Direct Recording feature is very handy if you are watching a program and want to record it as well. Now, there is no need to even select the same program position as the TV – simply press a single button to start recording. (This feature is available when the VCR is connected to the AV-out terminal at the rear of your TV.)

And their Auto SP/LP changeover helps to prevent timer recordings from getting cut off midway because there is not enough tape left. It intelligently detects when the remaining tape time becomes shorter than the programmed recording time, and automatically switches over to LP mode to ensure that the rest of the program fits on the tape.

Other useful features include G-Code recording, Panasonic's 4-key programming, easyguide on-screen display, front panel AV input for fast connection of a video camera or another VCR, multi-brand remote control with G-code compatibility, and NTSC playback on PAL TV.

■ *Pricing ranges from $373 for the NV-SJ200A, to $559 for the fully featured NV-FJ600A. For more information contact the Panasonic Customer Care on 132 600.*



# Triode mania

**THE NEW** 300B EH is a triode maniac's dream come true. Ultra-long life, top-quality construction, and superior sonics make this the finest 300B available today.

Like the original Western Electric 300B, the 300B EH has an eight course directly heated filament, 40 watt plate dissipation, classic large shoulder tube glass, and is available singly or in precision matched pairs. The 300B EH's plate curves and static DC characteristics (plate resistance, transconductance, mu) exactly match the WE originals so you can drop them into any vintage or modem 300B amp and realise the finest performance of any 300B made today.

■ *For more information contact Electro-Harmonix at info@ehx.com, or see them online at www.ehx.com.*

# Compact digital-video cameras

**JVC** has introduced a new selection of MiniDV digital camcorders, the GR-DVL300 and GR-DVL100, each equipped with a different combination of features. Both offer high-resolution DV video recording, a wealth of special effects and high-performance shooting features, as well as built-in DV in/out and Digital Still output connectors, all in a new compact size which is a first for this price range.

Both still and video images can easily be downloaded to or uploaded from a computer through the iLink (DV) terminal. Additionally, an exclusive serial port is also provided allowing direct connection to a PC for still image capture from DV footage and image transfer, with no need to install any extra boards.

The GR-DVL100 offers excellent value for an 'entry level' model with its 800,000-pixel CCD, Auto Light, 450x Digital Zoom, 2.5" LCD colour monitor, multiple connectivity, plus built-in special effects and scene transitions.

The GR-DVL300 takes a step up as a deluxe unit offering a larger 3.5" LCD colour monitor, a high-resolution colour viewfinder, and a provided package of image transfer and processing software.

■ *The GR-DVL100 has an RRP of $1759, with the more advanced GR-DVL300 coming in at $2099. For further information, contact JVC on 1800 225 044, or visit them on the web at www.jvc-australia.com*

# Be mobile across bands

**DESIGNED** to provide an entry-level for users in the dual band market, the GD30 offers greater coverage and advanced call quality in areas where two GSM radio frequencies (900MHz, 1800MHz) are available. In addition, dual band provides greater roaming capability, particularly when travelling overseas.

The new GD30 weighs just 135g, but despite its small size, it incorporates a large graphic display and has built-in vibration alert as standard.

The feature-rich GD30 measures 135 x 45 x 20mm. It offers 50 phone book memories on the handset, call alert profiles, predefined SMS (Short Message Service) messaging, screen animations, 20 ring tones, clock/date display, plus alarm and programmable Power On/Off. The standard battery has up to 180 minutes talk time or 90 hours standby. '

So that users can recognise the urgency of incoming calls in a discreet way, the GD30 allows you to identify five callers, with specific ring tones allocated to each number. A choice of 20 ring tones is available.

The mobile has 50 phonebook memories built into the handset in addition to those held on the SIM card. It also has a set of up to ten useful pre-defined SMS messages, which can be customised as required, making SMS quicker and easier to use. The extra-large display screen is also well designed for viewing and sending messages.

The GD30 is fully data compatible and can be connected to a laptop for email, SMS, fax and Internet access using Panasonic's optional software modem cable or a PCMCIA card.

The mobile also features Panasonic's 'Vibration Alert'. Users who don't want to miss a call – but don't want their mobile to ring because they are in a meeting – simply press one key to set the handset to vibration alert. Instead of ringing, a vibration silently attracts your attention.

The mobile is supplied with slim battery and lightweight AC adapter. Other accessories include car kit, portable handsfree, dual pocket charger, DC adapters, PC cards and leather cases.

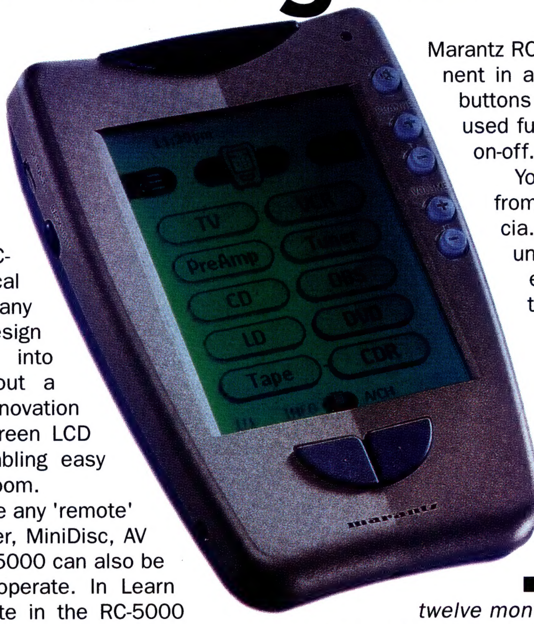
■ *The GD30 is available exclusively on the low cost 'PocketSaver' plans from Telstra. For pricing and plan information, contact your Telstra MobileNet dealer. For product information or your nearest stockist, call Panasonic's Customer Care Centre on 132 600, or access the Web at www.ivibrate.com.au.*

# As good as it gets

**WELL**, here's Marantz' latest entrant into the Universal Remote Controller market, the RC-5000. This king of kings is the big brother to it's highly revered RC-2000MII that made its debut earlier this year as 'The remote of the Gods'...

This evolutionary designed RC-5000 Universal Controller is a radical improvement on any controller at any price. Starting with its ergonomic design with contours that fit comfortably into the hand, the RC-5000 is without a doubt a showpiece. A welcome innovation to many will be the large touch-screen LCD panel that is self-illuminating, enabling easy viewing even in a totally darkened room.

Aside from being able to duplicate any 'remote' for use with a DVD player, CD player, MiniDisc, AV receiver, TV, VCR and tuner, the RC-5000 can also be one of the simplest remotes to operate. In Learn Mode, point the original key remote in the RC-5000 direction and then teach it the controls you need. You can also change the button labels so they match those on the original.



With a mere seven buttons plus LCD touch-screen panel, the Marantz RC-5000 offers total control of every component in a home entertainment system. The seven buttons also provide instant access to the most used functions such as volume adjust and power on-off.

You can even download appropriate software from Marantz US website www.marantzamercia.com via your PC – the possibilities are unlimited. The control codes from virtually every brand of infra remote control can be transferred to the RC5000 including popular brands of DSS equipment and components that use Philips RC-5 remote control codes.

For the ultimate convenience, flat batteries will never be a problem again; the controller has its rechargeable NiMH battery/mains powered docking station. Just store the RC-5000 in the docking station when not in use and it will stay fully operational at all times.

■ *The Marantz RC-5000 is covered by a twelve month parts and labour warranty and has an RRP of $899. For further information on the RC-5000 or other Marantz product contact Jamo on 1800 242 426 or email info@jamo.com.au.*

# Be your own DJ!

**MAKING your own CD compilations is now available at the touch of a button. Offering a complete range of CD recording options. Philips lets you choose from new mini systems with an integrated CD Recorder (FWR7 & FWR8), a mini component CD Recorder (CDR570), or dual deck CD Recorders.**

**The FWR8 is a complete mini system with an integrated CD Recorder. This unit features a convenient three CD changer that lets you record from up to three discs. With a powerful amplifier, digital tuner and a CD Recorder built in; it's an all in one CD Recording machine.**

**For people wishing to add a CD Recorder to an existing audio system. Philips introduces the CDR570 mini component. In a compact size, it provides an easy way to make personalised CD recordings from CDs and other digital source, and from any analogue source connected to the audio system.**

**The new CDR775 is a dual deck CD Recorder that features a dual play operation, with separate CD output signals from each deck for creative playback possibilities. It can also be used as a two-disc CD changer.**

**Offering even greater convenience and sophisticated CD recording options, Philips has launched the CDR785. With the added convenience of a three CD changer for playback and recording, make your own compilations from three separate discs in any sequence.**

**Philips' range of CD Recorders can record both CD-Recordable and CD-Rewritable discs, with up to 80 minutes recording time, and double speed recording. They all feature CD text recording input and editing facilities.**

■ ***The Philips FWR7 is $1199, FWR8 $1449, CDR570 $829, CDR775 $1099, and the CDR785 $1199. All models are available at leading electrical stores nationally. Call Philips Electronics on 1300 36 3391 for more information, website at www.philips.com.***

# Sony's sleek, stylish notebooks

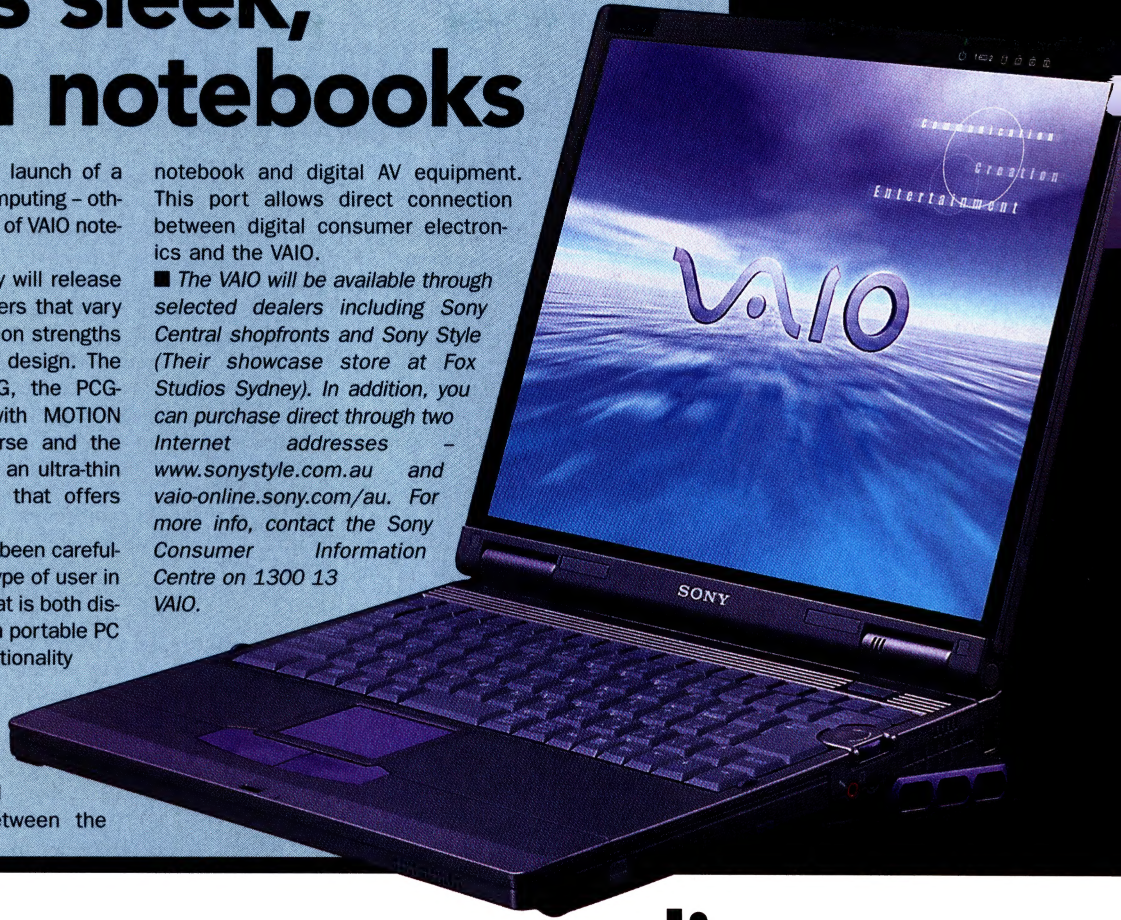
**SONY** have announced the launch of a new concept in personal computing – otherwise known as their range of VAIO notebooks.

In its initial line-up, Sony will release five VAIO notebook computers that vary in size, weight and application strengths – all with the stylish violet design. The models are the PCG-SR9G, the PCG-Z505FA, the PCG-C1XA with MOTION EYE, the PCG-XE7 workhorse and the PCG-F660. All models have an ultra-thin magnesium-coated chassis that offers extra durability.

Each VAIO notebook has been carefully designed with a specific type of user in mind and has a character that is both distinctive and unique – an ultra portable PC with high performance functionality and stylish design.

A unique feature, common to all VAIO, is the i.LINK port. i.LINK standardises the high-speed digital serial interface between the notebook and digital AV equipment. This port allows direct connection between digital consumer electronics and the VAIO.

■ *The VAIO will be available through selected dealers including Sony Central shopfronts and Sony Style (Their showcase store at Fox Studios Sydney). In addition, you can purchase direct through two Internet addresses – www.sonystyle.com.au and vaio-online.sony.com/au. For more info, contact the Sony Consumer Information Centre on 1300 13 VAIO.*



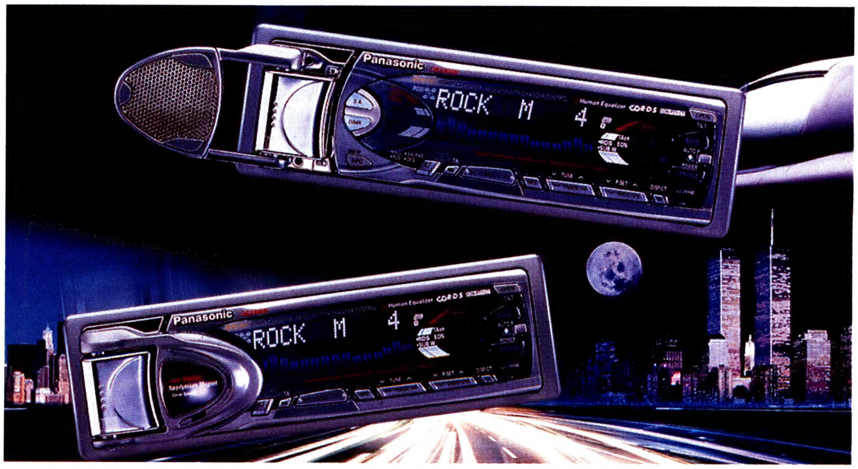
# Flipping over car audio

**PANASONIC** has introduced a car stereo system with the world's first flip-out centre speaker.

Incorporated into the front panel of the CQ-DRX900 CD player/receiver, the speaker – complete with its own dedicated 5W amp – flips out at the touch of a button to provide outstanding frontal image stability. It provides a new dimension in in-car entertainment that can't be achieved with an ordinary 4-speaker system.

James Robinson, Product Manager, Panasonic Car Audio, explained: "Generally, the sound image is less than ideal in ordinary car audio reproduction because the front speakers are located at leg rather than ear level."

The centre speaker is also designed to maximise the surround effects of Panasonic's DSP (Digital Signal Processor) technology. Thanks to DSP delay, listeners don't notice the differences in distance between the centre speaker and the door speakers to their left and right. When not in use, the centre speaker folds back across the front panel of the car stereo unit.



The CQ-DRX900 also features Panasonic's 'Day and Night' design for a dramatic daytime metallic mirrored look, changing to a glowing shade of electric blue by night

The CD/Receiver delivers 4x 60 watts of powerful sound plus the flip-out speaker's 5 watts, while the addition of industry-standard MOSFET (metal-oxide semiconductor field effect transistors) technology assists in dramatically reducing distortion to produce pure and natural musical output.

■ *The CQ-DRX900 has an RRP of $1282, and should be available from most car audio specialists. For more information, contact Panasonic's Customer Care Centre on 132 600.*

## Virgin calls

**VIRGIN** Atlantic airlines says it has become the first airline to allow passengers to receive mobile phone calls while in flight, and is also developing a system to allow passengers to send and receive email.

The phone system developed by British Telecommunications, allows passengers to charge air-to-ground calls to their GSM accounts and to receive mobile calls on the plane's handsets.

According to Reuters news agency, the passenger just swipes a Mobile Connect card through the aircraft handset, and dials a registration number. Callers to the GSM number pay only for the ground call.

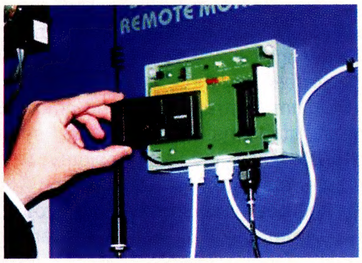
## Agilent power supply winners!

Congratulations to these lucky winners of EA's Agilent Technologies' Power Supply Subscription Promotion;

**N Babel, Albury North, NSW**
**M Everett, Rydalmere, NSW**
**M Whitehorne, Scullin, ACT**
**P Ljaskevic, Cheltenham, VIC**
**R Sterland, Chirnside Park, VIC**
**N Smith, Mirboo, VIC**
**B Walker, Lower Templestowe, VIC**
**M Fletcher, Chermside West, QLD**
**W Boulton, Maryborough, QLD**
**M Rieger, Hawthorndene, SA**

All of the above readers are now in the enviable position of owning an Agilent Technologies' E3631A triple-output programmable DC power supply. This professional 80W supply offers three independent 0 to +6V/5A and 0 to +/-25V/1A outputs, with the 6V outputs electrically isolated from the +/-25V supply to minimise interference between circuits under test. The +/-25V outputs can be set to track each other, as well as controlled independently, and the E3631A supports both GPIB and RS-232 interfaces.

## New remote monitor enhances safety control at rail crossings



**DIGITAL CELLULAR TECHNOLOGY** used to monitor equipment performance and operation at level railway crossings throughout New South Wales has been widely applauded by industry authorities. The Remote Monitoring Units (RMU) provide two way communication to control, monitor and collect real-time information automatically from difficult to access and remote crossings.

Developed by Call Direct Cellular Solutions, the RMU was initially introduced to eliminate the difficult and labour intensive task of collecting data from electricity meters and is now found at 8,000 sites around Australia.

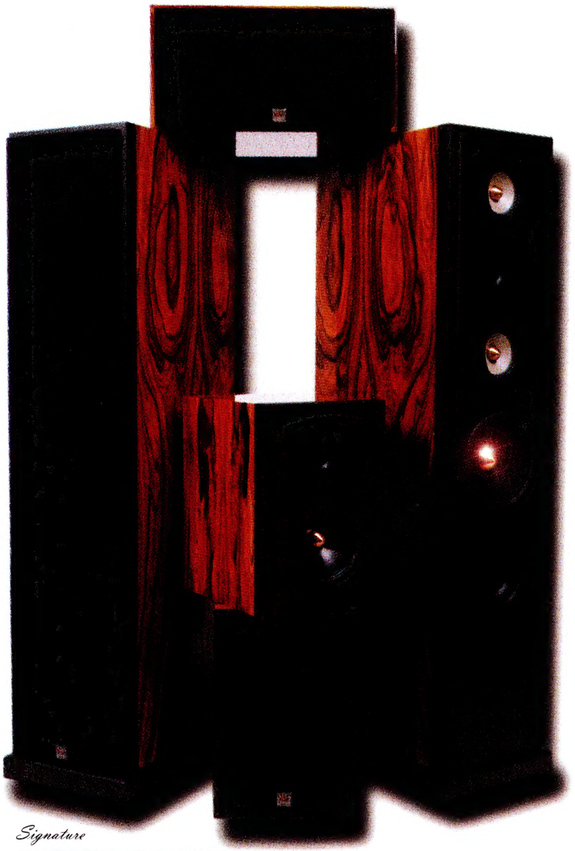
Commenting on the RMU, Mr Matt Richards of Railway Services Australia (RSA) stated, "We can immediately detect and rectify any faults that may occur with the boom gates, alarms, signals or lights. The system will automatically advise of any structural damage that may result from the elements or vandalism.

If there is a fault, the RMU immediately pinpoints and records where the fault has occurred and an alarm sounds immediately at the host PC (monitored 24 hours per day at the central control office). A technical consultant then dials into the relevant crossing immediately, and extracts real-time data using the RMU's two-way communication to pinpoint and record where the fault has occurred and immediate action is taken.

He added , "Previously each level crossing had to be manually tested daily by paid contractors. If a fault was detected, it could often take a full day just to determine the exact location of the problem. At a cost of between $4,000 - $6,000 to install an RMU, the system will save considerable expenditure and most importantly, will maximise operation efficiency at each level crossing.

In the Western Region of NSW alone, RSA was facing an annual cost of $250,000 for contractors and expensive land lines. The RMU eliminates these costs because of its ability to link to a GSM (global system for mobile communication) digital phonecard, said Mr Richards. For more information, contact Peter Jarrett on (02) 9965 7500 or email peteri@calldirect.com.au. ea

# "Simply...the best performance and value for money available!"



"One could be forgiven for thinking that these speakers were 10 times the price...The stereo imaging was truly outstanding...The VAF Signature I-51 system has one of the finest high frequency responses of any

Electronics Australia

"A new benchmark in excellence in every criteria: construction, design, finish, innovation."

*Best Buys* Home Theatre 97' 98'

"Highly and unreservedly recommended."

*Best Buys* Home Theatre

"Are these the best kit speakers in the world?...On the evidence, we'd have to say that VAF's I-66 design would be odds on favourite to take out the award."

*Best Buys* Speakers, Amplifiers, Receivers

"... In value for money stakes or even sound for dollar stakes for that matter, they're nigh on impossible to beat."

Australian HI-FI

"... don't think there's any other way you could obtain this high level of sound quality at such a low price..."

Australian HI-FI

"We love the DC-Xs. These are true high fidelity speakers, and deserve a pedigree second to none. we are confident that that will be the case in time. Their performance is a revelation. The combination of the DC-Xs, the DC-6 and DC-2s is a happy, fully compatible, articulate and balanced system that beats anything we can think of in its price range. Actually,probably close to twice its price range."

**Best Buys Home Theatre 98' 99'**

"The VAF DC-Series home theatre system exhibits a new benchmark of excellence in every criteria: construction, design finish , innovation...it seems almost churlish to mention the astounding value that each of these components represents."

***Best Buys* Home Theatre**

*Signature*

**SURROUND PACKAGE**

"All areas of the DC-X's performance could easily be attributed to models costing a great deal more...The very design of the DC-x sets a few new standards in speaker engineering, some of which help it achieve incredible levels of versatility across amplifiers and source products and Home Theatre applications...Amazing value!"

Audio Video Lifestyle Magazine

"Unmatched performance at the price.The new DC-2 significantly raises the standard by which speakers at its price will be measured. This speaker is destined to become a classic."

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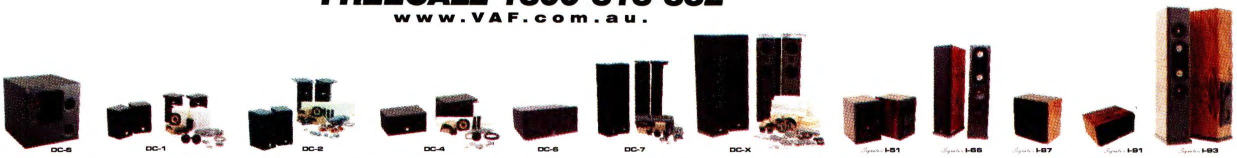
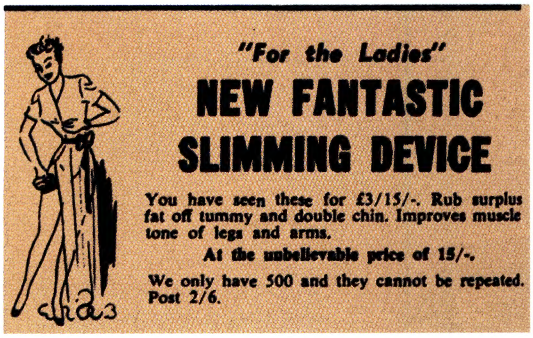


VAF Research Pty Ltd. 52/54 North Terrace, Kent Town SA 5067 Phone (08) 8363 9996 Fax (08) 8363 9997 e-mail:vaf@vaf.com.au

# Letters to the Editor



"For the Ladies"

NEW FANTASTIC SLIMMING DEVICE

You have seen these for £3/15/-. Rub surplus fat off tummy and double chin. Improves muscle tone of legs and arms.

At the unbelievable price of 15/-.

We only have 500 and they cannot be repeated. Post 2/6.

**Letters published in this column express the opinions of the correspondents concerned, and do not necessarily reflect the opinions or policies of the staff or publisher of Electronics Australia. We welcome contributions to this column, but reserve the right to edit letters which are very long or potentially defamatory. All contributions to EA will be considered for publication in this column.**

## Ouch!

I have read Jim Rowe's forums about 'Shonky Electrotherapy devices'in recent issues of EA.

I have recently come across an interesting advertisement "For the ladies - A new fantastic slimming device... Rub surplus fat off tummy and double chin. Improves muscle tone of legs and arms."

Where was this advertisement? – Radio, Television & Hobbies – April 1963 page 114. (For the youngsters, R,TV&H later become EA.)

This reminds me of something about "People in glass houses shouldn't throw stones"...

*Peter O'Connell VK2EMU,*
*Beverly Hills, NSW*

## Sour Grapes?

I refer to the letter from T Wilkie in the July issue of EA and I have trouble in coming to grips with his dismissal of the new format of the magazine. I have read EA in it's various forms for more than 50 years too. I think that the content is better than ever!

There is nothing wrong with the product reviews, in fact reading about new products makes the publication worthwhile, and I do not see any favouritism to advertisers rising from reviews.

The magazine is not trying to be all things to all people, but it is being a comprehensive publication to anyone interested in electronics. I defy anyone to say the construction and practical section is not excellent.

Electronics has changed dramatically over the past 50 years and I wonder how a better coverage of this complicated field of activity could be achieved? Surely the sad little letters of disapproval are not sour grapes.

*Lionel Doolan, New Lambton NSW*

## Two pins short?

I recently needed to make up a patch panel but I had run short of DB25s, so I ducked down to my local electronics store and picked up a few to finish the project. I had already measured and cut the holes out and when I went to install the connectors, some were sloping around and the holes did not line up. At first I thought my steel work was rough and just slotted the holes, but then I noticed that the new connectors were slightly smaller than the others. I put this down to different manufacturers standards and proceeded to wire up the panel.

When it came to wiring pin 20, I noticed there was something strange about the connectors. There were not enough pins next to pin 20. Closer inspection revealed that in fact these were in fact 23-pin connectors. Surely, this must be the four leaf clover of the electronics industry, and you are probably having trouble believing this — so enclosed is one of theses unusual connectors for you amusement. I, too, would have been amused if I had not lost a mornings work.

*Mario Messina, Box Hill Vic.*

*(As it turns out, Mario, 23-pin D-type connectors are not that uncommon — companies such as Dick Smith Electronics have been selling them for yonks. Obviously your connectors had found themselves into the wrong bin in the store... — Ed)*

## Bouquet — 1

I like your new EA format, the paper is more durable, and the print is much clearer for us oldies. I have been reading you since first finding Radio and Hobbies in the early 1950s, and have always found something of interest.

The Serviceman and Forum are usually the first things I look for. Keep up the good work with general interest articles.

*L.K. Price, (via email)*

## CDR compatibility

I have been following your articles on Dolby Digital surround sound with a lot of interest. I have been waiting for a company to bring out a complete AV tuner, DVD and speaker package so I could have a good priced digital sound system with DVD player.

The DVD player could surely play CDs and VCDs, so when Sony released it's DAVS-300 last week, I jumped in and bought one for around $1500.

I have a lot of records that I have transferred over to CD for easier listening, and was shocked to find that my new $1500 DVD player would not recognise any CDR disc, audio or VCD. There is not too many normal CD players that will not play an audio CDR, you can buy a CD player for $150 that will. I also have plans of purchasing a digital video camera and editing the images on PC, then storing the result on CD in VCD format. A test CDR in VCD format also did not play in the Sony.

I have returned the DAV-300 for a full refund, and with an audio CDR and a test VCD CDR in hand I proceeded to check other DVD players in the store. I was shocked at which would play CDRs and which would not.

The bottom of the line Philips DVD (you reviewed a few months ago) played both CDs without a hitch, but a top of the line $2000 Onkyo spat the dummy with a 'disc error'.

Considering the price difference it would seem the dearer the DVD the less chance it will play a CDR. I have trouble understanding this. The manual of the Sony stated it would play VCDs, which if I had an original VCD it probably would.

I would be asking the DVD manufacturers how many VCDs do you see in the store's these days? I have only ever seen VCDs popular with professional companies that hire out video clip collections to nightclubs etc. I would suggest that if a DVD claims to play VCDs these would be of the 'burnt on a CDR' type not just an original.

I am suggesting to EA that they should include with any review of a new DVD it's CDR, (both VCD and audio) compatibility, I am sure with the emergence of these complete systems (they are going to be very popular due to the price) many people (even EA) might be unaware of this issue.

*Craig Price, CJ Electronics (via email)*

*(Actually Craig, we do mention any problems we encounter with CD discs, as we have created a number of our own test discs specifically for doing the reviews. — Ed)*

## Bouquet — 2

Congratulations to the new editor and may he have a run as good as the last editors.

Now, concerning the new look of the magazine: I do like the new layout but I find the shiny paper very hard to read as it reflects the light quite badly, it seems to be much more shiny than the old paper.

My favourite articles are The Serviceman, Tom Moffat, open Fist, Vintage Radio, (I am into this myself), Forum, Computer Clinic, Information Centre, and most construction articles.

As you can see I really enjoy your magazine, by the way I have been getting it since 1950 and still have some copies of that era.

Well more power to your arm and thanks for all of the good reading.

*John Breden,*
*Te-Puke, New Zealand*

## Something for everyone

First I have some encouraging comments about the magazine design. It was inevitable but, someone had to do it and it looks great, too.

Sure there are some readers who despise the new design but, I guess it all comes down to politics in the end. I do have a comment to make about a reader who says your magazine is aimed at high income earners and the like.

I completely disagree with his comments. Every time I read your magazine there is always an ad for Jaycar, Dick Smith Electronics or Altronics or somebody else. After all your magazine is aimed at a wide population of readers to encourage more people to contribute and support your magazine.

Good luck with the magazine and keep up the good work.

*Logan Squires, (via email)*

## More topless shots?

I read in last month's letters to the editor some criticism of reviewing expensive commercially available equipment because most readers can't afford it but who cares ! I love hearing about the latest and greatest merely to keep informed.

I also appreciate the 'covers off' photographs of equipment, the more of that the better, as for the layout changes I think it's not a backward step but everybody is wary of change in all facets of life nowadays.

*Michael Livingstone, (via email)*

# Electronics Australia Reader Services

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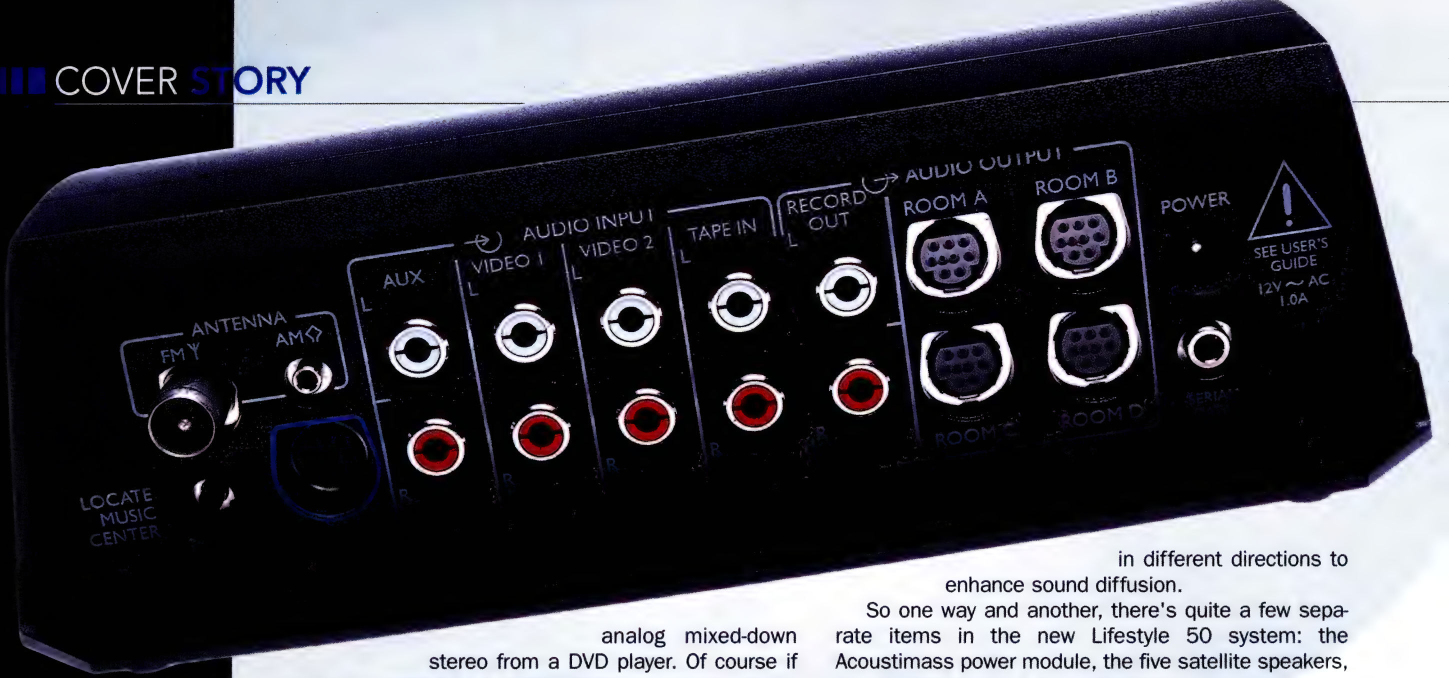


***The rear** of the Multi-Room Interface box, where most of the system's 'smarts' are located.*

***Shown opposite** is one of the Bose powered extension speakers.*

analog mixed-down stereo from a DVD player. Of course if the DVD player has a digital bitstream output, this is connected directly to the digital lead from the power module, and the system automatically selects that signal instead.

I should note here that the digital decoder in the Bose power module can only handle Dolby Digital and LPCM bitstreams, not DTS or MPEG2. (Not that this is likely to be a serious limitation.) It also provides only a *coaxial* S/P-DIF input; there's no optical (TOSlink) input. However if your DVD player can deliver mixed-down analog stereo from discs with DTS or MPEG2 tracks, you'll be able to use the system's Videostage 5 analog decoding to deliver reasonable surround sound. The DSP that provides the Videostage 5 processing can do this with standard stereo sources as well, and even provides pseudo surround from mono sources.

The system's CD changer is basically the same as that used in previous Lifestyle systems, and is somewhat unusual in that there's no drawer to let you play a single CD easily. It only plays discs loaded into the special Bose six-disc side loading magazine, which itself loads into a slot in the front of the changer under the swing-up front panel. All playing functions are controlled remotely via the PMC.

Needless to say the Lifestyle 50 system's power module is based on the same tried-and-proven Acoustimass woofer system used in previous Lifestyle systems. This has two 133mm bass drivers in a triple-compartment bandpass type enclosure, with all of the outputs from the various compartments ultimately emerging from a single large flared port. It's designed to handle all of the system's output below about 230Hz, and produces very clean bass down to 30Hz or so.

Teamed with this bass unit are five identical satellite speaker units which handle all of the middle and upper frequency output for each of the five surround channels. And as you'd expect from Bose, these 'Jewel Cube' speaker units are positively miniscule: they each measure only 112 x 56 x 81mm. Yet each one actually consists of TWO separate tiny rear-ported enclosures, each fitted with a nominal 50mm widerange driver. The two pivot on a central vertical axis, so they can be directed in different directions to enhance sound diffusion.

So one way and another, there's quite a few separate items in the new Lifestyle 50 system: the Acoustimass power module, the five satellite speakers, the CD changer plus its magazine and the Multi-Room Interface with its plug-pack supply, all linked up with various cables (which are all supplied). Plus, of course, the all important Personal Music Centre control unit. Luckily once it's all installed the only bits you tend to see are the CD changer and the PMC, both of which are fairly compact and nicely styled. The CD changer measures 394 x 203 x 66mm, while the PMC is only 224 x 105 x 36mm and weighs 400g.

## What we found

Bose Australia kindly made available a sample Lifestyle 50 system for us to evaluate, and the first thing we discovered when we unpacked everything from the box was that along with all of the system components listed above, plus the usual Owner's Guide, Bose also supplies two CDs. One is an introductory and test disc, to help you check your speaker connections and balance the channels, and the other is a demo disc with samples of various kinds of music to show off the completed system. Very thoughtful.

As it happens there's also a 'quick setup' poster, and I found it very easy to set everything up using that as a guide. It all went together very smoothly, and in very short order I was driving the PMC and using it to listen to AM and FM radio stations. Then it was simply a matter of working out how to load some CDs into the changer's magazine, after which I could listen to these as well.

Now carrying out objective measurements on this type of highly integrated system isn't easy, especially as Bose is in any case rather coy about even basic technical specifications like power output, frequency response and so on. So after studying the Owner's Guide I decided to reverse the usual procedure and carry out the subjective listening tests first, before even attempting any measurements.

First I listened to familiar tracks from my usual reference CDs, and straight away gained the impression that the Lifestyle 50's overall reproduction was not only rich and satisfying, but very smooth and well balanced as well.

**"BOSE IS RATHER COY ABOUT EVEN BASIC TECHNICAL SPECIFICATIONS, LIKE POWER OUTPUT..."**

Next I hooked it up to the bitstream output from my DVD player (Kenwood KVF-5010), and tried viewing and listening to 'demo' scenes from my usual reference movie discs. This was with the system's 'Film Bass' mode activated, by the way, which according to the manual gives the correct tone control settings for movie soundtracks. The results were very satisfying indeed, with excellent surround sound steering on good Dolby Digital 5.1 tracks, and almost equally satisfying depth on 4.0 and Digital Surround/Pro-Logic tracks.

Frankly, it's hard to believe that the directional sound you're listening to is coming from those tiny little speakers, and that all of the system's smooth and convincing bass grunt is coming from that single and quite compact subwoofer module. Bose designers have certainly mastered the tricky art of balancing this kind of single-bass-module-plus-tiny-satellites system, and getting very satisfying reproduction from it. It left me in no doubt that the Lifestyle 50 is able to produce very satisfying home theatre surround impact.

Thus encouraged, I decided to try a few measurements. First up, after discovering that the satellite speakers have an impedance of just over 6Ω, I tried measuring the power output of one of the satellite channels into a 6Ω resistive load, and also the frequency response from one of the analog line inputs (in stereo mode). The results were interesting, too.

What I found was that with both front channels driving 6Ω loads, each power amp could produce just over 40W before clipping. I could detect tiny glitches coming into the waveform at the 15W level though, suggesting that some kind of overload detection/protection circuit may be set for that level.

Measuring the frequency response of the channels from the tape inputs to the amplifier outputs, I obtained a curve that was definitely not flat. It had a peak of about 6dB at 700Hz and two larger peaks of about 9dB at 250Hz and 12kHz, with quite steep rolloffs beyond these two outer peaks. But everything was well controlled and clearly quite deliberate – carefully designed to complement and compensate for the acoustic performance of those tiny satellite speakers, no doubt, in order to deliver a smooth and extended final result.

I wasn't able to measure the actual acoustic performance of the satellite speakers properly, due to problems with the IMP testing system. However I did do a rough check with an audio generator and sound level meter, which did suggest that above 250Hz or so their performance is the complement of that electrical response. I also did a check of the overall response through the Bose amp and centre channel satellite speaker, using a test CD and the sound level meter again, which suggested that the electrical compensation was indeed quite effective – giving a response smooth within about +/-2dB between 250Hz and at least 14kHz.

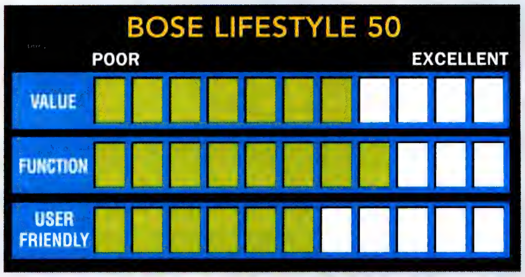
I also checked the output of the bass module in the same way, and found that it indeed delivers smooth and clean bass from 240Hz or so right down to 30Hz. There are small bumps at 40Hz, 75Hz and 170Hz, as you might expect from this kind of triple bandpass system, but overall the performance is very impressive.

By ear too, the crossover between the satellites and the woofers is very smooth and transparent, confirming that the Bose designers have done a good job.

So although I wasn't able to do much in the way of solid measurements, and there are no real technical specs to compare them with anyway, the bottom line is that the Bose Lifestyle 50 system seems to deliver solid, credible performance. It provides enough output to create a convincing surround sound stage in a home theatre situation, and most of the facilities needed to deliver this from modern DVDs and laserdiscs with Dolby Digital tracks of almost any level from mono to 5.1 channels. Plus all of the facilities for a good home music system, of course.

The idea of having it all controlled solely via the touch screen on a 'super remote control' is also an innovative one too, and turns out to be very convenient once you get used to it.

I guess my only real gripe is with that magazine-loading CD changer. As one who likes to listen to many different CDs, I would find the need to load them into the magazine and unload them again a real pain in the butt. Frankly I prefer a standard drawer-loading single disc player, but I guess it's a matter of taste. **ea**



**BOSE LIFESTYLE 50**

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### SUMMARY

- A highly integrated home theatre sound system based on the concept of a bass module plus tiny satellite speakers, and all controlled via a radio-linked hand-held Personal Music Center, with touch screen.

### PROS

- Dolby Digital 5.1 decoding as well as analog Videostage decoding.
- Tiny satellite speakers don't dominate your room, but deliver satisfying performance.
- Personal Music Center very convenient to use.

### CONS

- Quite a lot of bit and pieces to hook up, lots of cables.
- No optical input for S/P-DIF bitstream audio -- only coaxial.
- CD player only plays discs loaded into its six-disc magazine, which can be a bit inconvenient.
- A bit pricey (gulp!)

### RRP

- $7218 (inc GST)

### AVAILABLE

- Bose dealers, or contact Bose Australia, 1 Sorrell Street, Parramatta 2150. Phone (02) 9204 6111 or 1800 023 367, or visit the company's website at www.bose.com.au.

## MOFFAT'S **MADHOUSE**

**BY TOM MOFFAT**

# Seek and **ye shall find**

**ONE OF MY FIRST** articles for EA, over ten years ago, was called 'The Gentle Art of Scrounging'. This was inspired by a trip to Sydney when the city council was holding its annual clean-up. Residents were encouraged to put unwanted items out by the street for council trucks to pick up and transport to the local tip.

Some people feel it is necessary to rescue certain items before they are sent to junque heaven, and the article gave careful instructions how one could disguise oneself as a jogger to pull pre-dawn raids on the piles of goodies awaiting collection. Fully functional televisions and lawnmowers were among items sighted during research for the article.

Although ten years older now, I still retain my thrifty trait of cheapskateness which has served me well in the past. "Never throw anything away" is what I say. And never let anyone else throw anything away either. Anything disposed of today will be absolutely essential to the continuation of your life by tomorrow. Following these principles has made me the owner of one very fine computer, custom built, at almost no cost.

One of my many occupations is tech support for computers, mostly in people's homes. One day an old client called and said his faithful machine would no longer boot. In fact it would no longer do anything other than sit there and spin its hard disk. Investigation revealed that the computer's hard drive was kaput.

The computer used a 486 processor and had a grand total of eight megs of memory, well below the state of the art. Replacing the hard drive would be a waste of money. So we ordered a nice new Dell computer, and when it arrived I returned to set it up for him. When the screen lit up, his eyes lit up, and he was in love with the Dell from its first beep. As I left I said, "what are you going to do with the old computer?" "Take it with you", he said. It wasn't good for anything if it wouldn't work.

I mumbled something about it becoming a transplant donor for other sick computers, but deep down inside I knew that computer would have another life. We'd given it a brand new modem a couple of months previous, it had a great sound card, and a lovely Chicony keyboard with a built-in trackball. The only thing missing was a working hard drive, and the monitor which the client had retained to use with his new Dell.

So I put out a message on the internet 'for sale' newsgroup: "Wanted to buy, a medium-sized hard drive, and a VGA monitor". Within a couple of days I had two hard drives, which the owners refused to take any money for. As for the monitor, there were no responses to my ad, so I had to go legitimate and contact a computer shop. Computer Renaissance, which deals in used stuff, quoted me $150 for a used 12-inch VGA monitor. Fooey! Outa sight!

## Another ad

So I stuck another ad on the newsgroup, which produced the offer of a top-of-the-line Gateway 2000 computer of senior years, complete with monitor, for $30. This thing had cost its owner, a research scientist, well over $5000 when new. So I offered to let him keep his computer; all I really wanted was the monitor. But no, he said, if you take one you take them both. I got the feeling he wanted to be rid of it.

So the monitor went onto my 'new' 486 machine, and the Gateway sat around my house for over two years until another client told me her young son would like to have a computer to take apart and play with. Bingo! The Gateway had a new home.

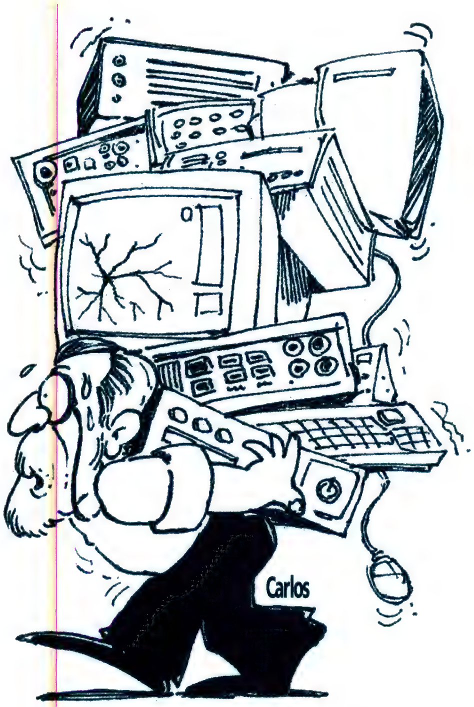
The hard drives turned out to be 500 and 100 meg, so I installed both of them on the 486 as the C: and the D: drives. I've always liked the idea of having a separate drive for storing data, distanced from the software which could crash and destroy the C: drive.

The computer had originally used Windows 95, upgraded from Windows 3.1, and it barely ran at all in that tiny eight megs of memory. So I formatted both hard drives and proceeded to turn that computer into one of the most stable configurations ever devised: MS-DOS 6.22, and Windows for Workgroups 3.11. These were both the last, and finest, releases of this software.

I loaded DOS with my favourite collection of flight simulators, and pinball machines, and satellite trackers, and my Listening Post weatherfax stuff, and... and... everything wonderful! Windows, in conjunction with that almost-new modem, produced a very nice internet machine: Trumpet Winsock (a fine Tasmanian product) for the internet connection, Opera for the web browser, Eudora for e-mail, WS-FTP for file transfer, etc, etc. It all worked smooth as a baby's bottom, except for one problem: The damn thing wouldn't start in cold weather.

I messed around for ages trying to fix this, but it was like all intermittents: when you sit down to study the problem, it disappears. When it failed, the machine produced a message that it couldn't find the D: drive, so I tried a different disk controller, new cables, and contact cleaner in the motherboard slots, But it still refused to boot on cold days. I eventually decided it was too cold for me to use the computer on cold days, so that fixed the problem, in a roundabout way.

**"NEVER THROW ANYTHING AWAY" IS WHAT I SAY. AND NEVER LET ANYONE ELSE**



## Learning Linux

Two years on – this year – I decided it was time to learn the new Linux operating system. Linux has immense powers of destruction in the hands of a fool (me) so there was no way I was going to let it into my main computer (the Sony laptop).

That left the cold-hating Scroungeorama as the future test-bed for Linux. The literature said Linux would run in a 386 computer with only four megs of memory. I had a 486 with eight megs, so it should work fine. But I decided the 500 meg hard drive might be a little on the light side. Anyhow, I wanted to preserve that drive intact in case Linux turned out to be unusable on that machine. Before long I was called out to install yet another new Dell, and a few broad hints produced a 1.5 gig hard drive and an almost-new disk controller and multifunction card from an old machine the owner had stored away.

Major surgery: out with the 500 meg hard drive, in with the 1.5 gig, out with the old disk controller, in with the new, format the new hard drive and then run the Linux installation CD. You've probably heard that Linux is hard to install. It is. But that's what I was here for – to learn. Eventually most stuff started working, except for the Chicony trackball and the sound card. With the modem cooking nicely I could now get online with telnet and FTP and ping – all the stuff we used to use on the internet before the World Wide Web ever made its appearance. It all still works, you know, fast as the wind...

Linux can be used with a graphical user interface (GUI) which is supposed to make it look and feel like Windows. But in that eight megs of memory, Xwindows bungled and tripped and bounced off the walls, thrashing the hard drive for all it was worth to use it for 'virtual memory'. And as for running Linux Netscape, I succeed only once, after it took it nearly twenty minutes to load. So more memory was in order; perhaps 16 megs. But the elderly motherboard used memory of the kind they don't make any more. What to do? What to do?

## Monster tower

Ad in the local paper: "Swapfest this Saturday morning, bring your old stuff, take away new stuff!" So I collected together some old and mostly useless computer boards, and headed off to the showgrounds hoping to find someone with a newer motherboard that was surplus to requirements.

I soon discovered the computer table, and right in the middle was the biggest tower computer I've ever seen. I stood over a metre high. When I looked inside, all the disk drives, modem, video card, everything, had been stripped out. All that remained was the power supply and the motherboard. MOTHERBOARD! It was bigger than my old one, had serial and parallel ports and even a USB port on the main board. There was a processor with a fan on it, probably a Pentium of some kind. And lots of memory modules. The computer had a handle on top, so I grabbed it firmly to lay claim to my prize while I waited for the owner to turn up, ready to barter.

**THROW ANYTHING AWAY EITHER.**

The only person to turn up was a showgrounds official, who said bartering was not necessary. If you want it, take it. Leave something on the table in return. So I hefted the big tower off the table, scattered a few computer boards in its place, and dragged it back to my car.

I didn't want that enormous case, only the motherboard, and maybe the power supply for good measure. I had brought along some tools for just this eventuality, and I soon excised my prizes from the tower. Then I carried the empty case back to the table, just as the official arrived again. "I thought you took that," she said. Oh, er, um, I decided I didn't want it after all, um, er. So I made it look real heavy as I sat it back on the table, and then split. I didn't want to be stuck with all that scrap metal. Maybe someone else was looking for a case...

My swapfest find seemed to be saturated in good luck. That night I noted the make and model of the motherboard, got onto the internet, and soon had downloaded a complete instruction manual for it. The next morning there were computer guts all over the floor as I dismembered the 486 and installed the new motherboard. And when it fired up, it announced itself as a 120 MHz Cyrix computer (almost a Pentium) with, would you believe, 64 megs of memory.

It worked great on the first pop. Absolutely great. Linux smoothed along effortlessly, even when burdened by Netscape. And then I got this idea: why not stick the DOS hard drive back in as the secondary drive. Now I can turn on the machine with a DOS boot disk in the floppy drive, and it's my old DOS/Windows computer, back again in the new motherboard. Or let it boot without floppy, and it's Linux. Linux can even see the DOS drive. My, what a fine computer. And it no longer fears the cold. All for the price of a $30 monitor! ea

OPEN **FIST**

BY STEWART FIST

# Apoptosis:
## what are the triggers?

**BIOLOGICAL RESEARCH** has bred some dreadful jargon. I still have problems pronouncing 'epidemiological' when I need to speak in public on the subject, and the terms 'apoptosis' makes me regress to primary school years when I stuttered.

Unfortunately its a word we need to know, because it is central to the whole question of non-ionising radiation and health. Apoptosis is one of the most important functions of biological mechanism because cancer is probably best seen as a failure of apoptosis.

The term means 'programmed death' or 'instructed suicide' and it is applied to a particular form of cell death, sometimes initiated by the dying cell itself, and sometimes directed from outside the cell by its neighbours. The term apoptosis is used to distinguish this form of enforced cell demise, from necrosis, which is death caused by damage.

When you cut yourself with a sharp knife, that is necrosis. A narrow plane of skin cells get irreversibly damaged by the cut and will die.

However, on either side of the cut, the living cells will suddenly experience reduced pressure from their neighbours, and this will trigger a change in cell-functions, conveyed by calcium ion-flows between and within the surviving cells. These cells then begin to divide.

The process of division, where one cell becomes two, is known as mitosis, and in some cell-types (but not all) this division occurs spontaneously throughout life. But whenever one cell becomes two, we've got the potential problem of exponential growth.

There are two sides to a cut, and cells on both sides will be dividing and duplicating themselves. So it is quite possible, in this example, that you'd end up with more cells than before. And if this happened the replacement tissues would be dense, raised – and, in fact, 'scar-like'.

**WE ALL HAVE A HALF-DOZEN OF THESE PRE-CANCEROUS CELLS IN OUR BODIES**

But over time, some of the extra cells will be progressively programmed to die, and gradually the tissue will be restored to the original density. This is how apoptosis works to restore the tissue after damage. The unknown questions, are how cells are chosen for apoptosis, and how the suicide instruction from outside are mediated and ensured.

Tumours (either benign or cancerous) are a problem of uncontrolled cell growth – or mitosis without the balance being restored by apoptosis. For a tumour to form, the normal suicide-instruction mechanism must have failed, and it's possible that the immune system has failed also. But let's not complicate matters.

Many scientists working in the area of cancer research now believe that normal, healthy humans regularly have cells which are in a pre-cancerous stage. In other words, they believe a cell-malfunction, which initiates a cell going into uncontrollable growth, is not a rare event. In fact some scientists would claim that we all have a half-dozen of these pre-cancerous cells somewhere in our bodies at any one time, especially if we are over fifty.

Fortunately, when both the apoptosis mechanism and the immune system functions are normal, our bodies automatically suppress these pre-cancerous changes. Something happens to destroy the aberrant cells, and we are generally none the wiser for our brief flirtation with serious health problems.

This model of cancer causation raises a couple of questions. If this is the case, then there's really no difference between the cancer 'cause' and a cancer 'promoter'. So the old argument about R/F not causing cancers, but perhaps just promoting existing ones, doesn't hold water. Everything causal can also be seen as a promoter and vice versa.

### Many assaults

We must also remember that there is rarely a single causal mechanism for cancer. Only a few substances are known to cause cancers on their own; so virtually all cancerous substances require the accumulation of numerous 'assaults' on one particular cell before the cell is triggered to go into the cancerous stage.

In all cases, the damage appears to change the dynamics of how the DNA in that cell functions, which is why genetic variations might provide one or more of the 'pre-cancerous' causes and make some family-lines much more susceptible than others.

This is what makes cancer so difficult to research and to treat; there appears to be the need for the accumulation of multiple causal factors before uncontrolled growth is triggered. Some of these factors may effect the cell itself, and some may be impacting on the immune system. Some may be there at birth, and some may take sixty years of gradual accumulated damage before any once cell reaches the cancerous threshold.

We know, for instance, that asbestos particles cause lung-cancer yet asbestos is one of the most unreactive substances known. Its actions are probably physical. But asbestos also causes a type of pleural cancer called mesothelioma, and ex-workers often only begin to suffer 40 years after exposure ceased – but then die within a few years.

We also know that smoking causes lung cancer, but it has an entirely different mechanism, which is still not well understood. Then we know that the combination of asbestos exposure in the work place, and a life-time of smoking, makes the probability of lung cancer much greater than either 'causal' factor alone. We don't know why.

Add to this complexity, genetic susceptibility factors and you've got a very complex study problem, and yet this is one of the easiest of cancers to research. This is why epidemiologists have such a hard time coming up with definitive answers, evidence, or proof of disease causality. We expect too much of the epidemiologist. However their statistical reports can give us 'suspicions' worthy of further investigation.

## Sting in the tail

I've got off my original point, which was the question as to how unwanted or aged cells are instructed to die. We now know that each time a cell divides, the tail end of the DNA molecule changes, and a small length of code is lost. This tail is called the telomere, and when after many divisions it runs out of available length, and then the cell goes into its auto-destruct mode.

One of the more interesting aspects of the animal cloning experiments recently in the UK, is that the cloned sheep appear to have old (reduced length) telomeres. They don't start from scratch as do newborn infants, and therefore the cells of these clones appear to be aging prematurely. Efforts are now being made to reverse the shortening of telomeres, and so influence the aging process.

However cells don't only select themselves for apoptosis using factors such as age. In the simple case of the skin cut outlined above, it is actually some of the newest cells that are being told to suicide.

Cells seem to communicate with each other using special proteins (enzymes), and through ionic electro-chemical flows, mainly associated with the calcium ion. When a cell has a problem, it gives out some sort of electro-chemical signal which can be interpreted by other cells nearby, and they will then combine in some way to instruct the damaged cell to die.

There's a growing body of knowledge about these interactions, and many of the scientists working in the radio-health area are much more interested in this aspect than they are with the possibilities of cellphones giving people brain tumours and the like. Their research is directed at finding out how this electrical-ionic signalling works, and they are hoping to be able to influence cell functions in the future for therapeutic applications.

Many researchers also relate the way cells in tissue appear to interwork, more to the functions of a 'colony' than to elementary parts of biological tissues and organs. Bees in a hive seem to exhibit similar forms of group intelligence which appears to us, as outside observers, to be far above the level of intelligence of the individual bees.

Cells in tissue seem to have these same characteristics. In fact, Professor Ross Adey, a top electromagnetic biologist, writes constantly about the way cells "whisper" together using ion flows and enzyme expressions. These electro-chemical functions all appear likely to be affected by electrical or magnetic fields, so the question is whether external electro-magnetic influences are likely to be detrimental or not.

The claim that we have always existed in an environment having magnetic fields is not really a good answer (although it is trotted out regularly), because the earth's magnetic field is relatively static (although we move through variations in the field). And there is little doubt that we've been well protected from extra-terrestrial EMFs for a few million years.

But within a few dozen years, we've changed both the electrical and magnetic environment around us quite drastically. We now live in a 'blue smog' of EMF and exist within ever-fluctuating magnetic fields. And quite frankly, we just don't know what subtle effect this might be having on some of these basic cell functions. ea

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# BIONIC

With the relentless push of technology giving us electronic devices that are faster, better and cheaper than ever before, it's easy to forget perhaps the ultimate in personal electronic equipment – artificial organs. **Michael Fitzpatrick** looks at some of the latest advances in this field; devices that as it turns out, will last longer than we do...

# MAN

**NORMA WICKWIRE** is something of a bionic Granny. A total of eight of her major joints have been replaced by doctors, and she now takes pride of place at age 78 in the 2000 Guinness Book of World Records under the heading of Medical Extremes. Should she ever need man-made internal organs to match, she shouldn't have to wait too long. Recent research into artificial organs suggest that replacing our worn out plumbing with something more robust will soon be as common as hip operations.

As substituting parts of our creaking frames becomes increasingly old hat, many doctors and scientists are now concentrating on developing artificial organs. One Japanese researcher in his efforts to perfect an artificial lung even has plans to endow the body with additional organs. Noriaki Matsuda of Tokyo's Waseda University is building an artificial gill that will enable divers to breathe oxygen from sea water.

However, bionic additions needn't be so seemingly far fetched, particularly where existing organs are concerned. Replacements for all the larger organs are in the pipeline and a mechanical substitute for the simplest of them all – the heart – is already in production.

Elementary as it is, the heart, of all the body's mechanics, is the most prone to fail. Accordingly it has attracted the most money and attention. In heart transplant operations, where there is an acute shortage of donors and the failure rate of many transplants is high (one in five recipients die within a year), the need for a superior surrogate makes sense.

## Electric heart

As you might expect, the cardically-challenged Americans are ahead in this game. US engineer and inventor Robert Jarvik, for one, has created an artificial thumb-sized heart that will fit in the chest. It could answer the prayers of the many thousands of heart disease sufferers. Robert's company Symbian claims that it will not only solve organ rejection problems and will help put a stop to the one in three deaths caused by heart disease, but the tiny pump has an advantage over our own mortal muscle – it will last forever.

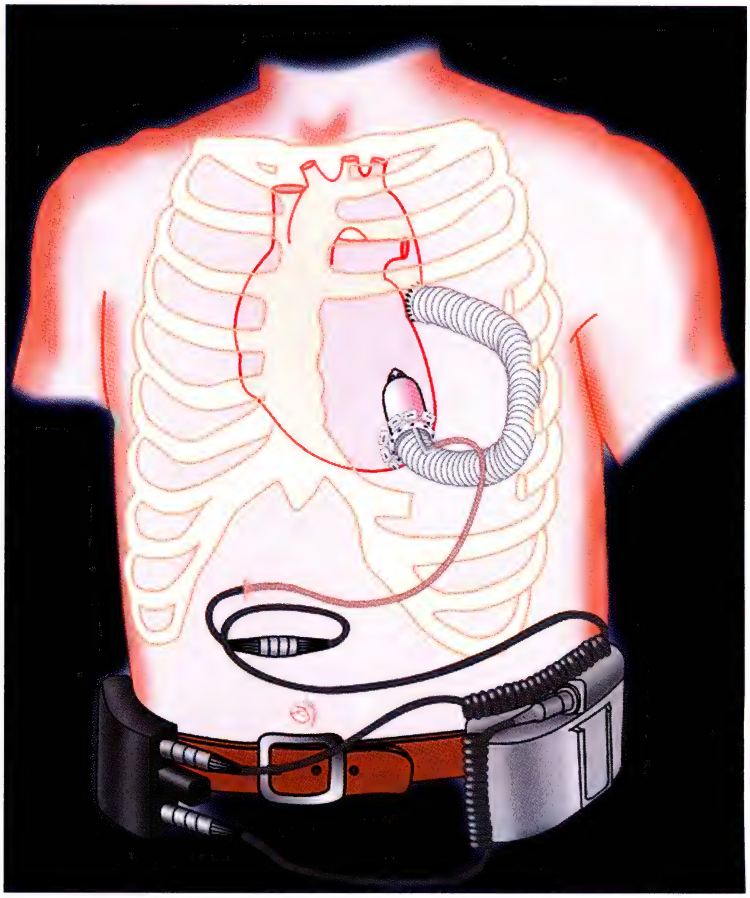
Jarvik's latest prodigy, the Jarvik 2000, has a tiny titanium turbine capable of pumping eight pints of blood a minute. Power is provided by a pocket size rechargeable battery linked to the device by a wire that emerges from behind the user's ear.

Demand for such a device may be greatest in the States, but the honour of fitting the first mini-heart has fallen to a British team. Surgeon Steve Westaby at John Radcliffe hospital in Oxford plans to have the world's first miniature artificial heart implanted in a patient by the end of this year.

"It's a revolutionary new concept in realistic artificial hearts," he says of the miniature unit. "I think this will be a realistic device in widespread use in patients with heart failure. I believe they will become as common as pacemakers."

A pioneer in artificial heart surgery, Westaby recently performed a successful operation on a child using a much larger German designed heart that pumped blood from outside the boy's chest.

"There have been enormous improvements in this field, which has enabled us to use an artificial heart on a child – to carry the child over from being virtually



***Above:*** *You have to put the batteries somewhere... The Jarvik 2000 is powered by a small wire exiting the body behind the left ear.*

***At left:*** *A complete replacement artificial heart being developed by Japan's National Cardiovascular Centre. Unlike earlier designs, it has two pumps to mimic the real thing.*

***Patients undergoing*** *dialysis at Kokura Daiichi Hospital, Kokura, Japan. 50% of dialysis patients in Japan have survived for at least 12 years, giving Japan the best track record for kidney dialysis in the world.*

***8000 hollow fibres*** *of polysulphone inside this hemofiltration device are lined with proximal tubule cells that reabsorb nutrients and pass them back into the patient.*

dead to getting a transplant. The Jarvik device is very much better than anything that exists at the moment that's for sure," says Westaby.

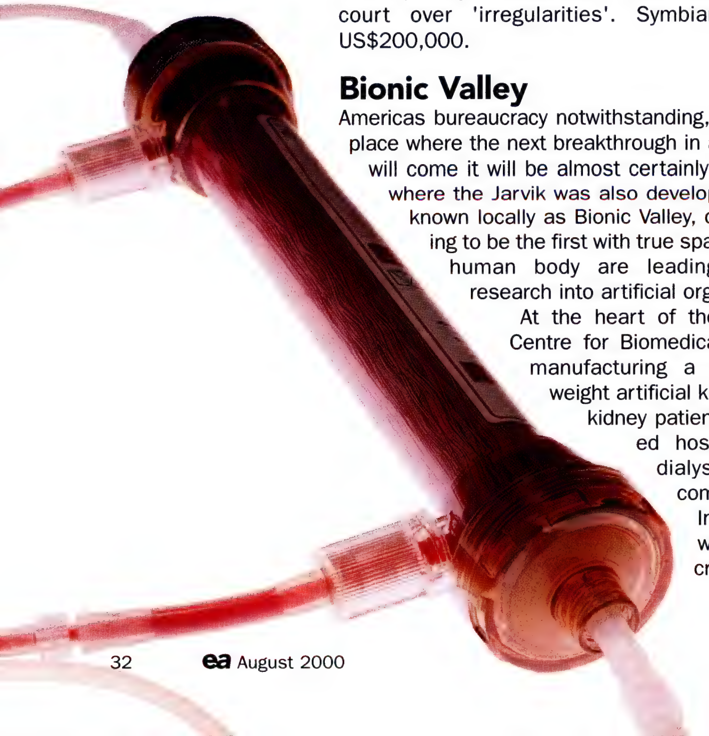
Earlier operations were not nearly so successful. Indeed, operations to fit battery-powered artificial hearts into heart disease patients were halted at Westaby's hospital and Papworth Hospital, Cambridge, when all five patients died last year.

All such surgery so far has been funded by charity says Westaby as the NHS does not yet support such transplants. The NHS stance is perhaps understandable given the recent controversy over heart transplants for children. There is also the legal wrangles and what Westaby call 'bureaucratic' difficulties over the Jarvik hearts in the States.

The Food and Drug Administration (FDA) in America were concerned enough over several serious shortcomings in the artificial heart program related to an earlier prototype, the Jarvik-7, that it took its makers to court over 'irregularities'. Symbian were fined US$200,000.

## Bionic Valley

Americas bureaucracy notwithstanding, if there is one place where the next breakthrough in artificial organs will come it will be almost certainly Salt Lake City, where the Jarvik was also developed. In an area known locally as Bionic Valley, companies hopping to be the first with true spare parts for the human body are leading the world's research into artificial organs.



At the heart of the valley is the Centre for Biomedical Design, now manufacturing a portable lightweight artificial kidney that frees kidney patients from repeated hospital visits for dialysis. Another company, Vascular International, is working on the creation of artificial blood vessels – some to replace arteries, others as fine as our own capillaries.

Ear implants for the deaf is another promising area for clinical trials. A six-channel electrode implant in the cochlea, developed at Salt Lake City's University of Utah, is also undergoing testing in 45 people worldwide who have lost their hearing.

However, it is a Southern Californian company that has had most success with such ear implants. Advanced Bionics' Clarion device, aimed at aiding the severely deaf, is selling excellently despite some reservations about its effectiveness and calls from some quarters for a moratorium until its safety can be guaranteed. Advanced Bionics has spent US$30 million on research for the $17,000 a piece Clarion cochlea implant, which received the OK from the all-powerful FDA only two years ago.

Children can also be fitted with the device which will transform the education of the profoundly death says Jeffrey Greiner, president of Advanced Bionics. "The educational opportunities that result from receiving Clarion are exceptional. By introducing a child to a world of sound through Clarion, that child has the opportunity to acquire speech and language, be mainstreamed in school, and meet his or her full career potential."

Clarion works by bypassing the damaged parts of the auditory system with digitised sound sent directly to the auditory nerve. Like normal hearing, the auditory nerve carries these electrical signals to the brain where they are interpreted as meaningful sound. In a delicate operation, the cochlea implant is grafted into the bone behind the ear and then connected to an external speech processor, a powerful mini computer, that converts the sound into the required signals.

## Lungs or gills?

Bionic ears are here to stay, but other parts of our anatomy are still proving difficult to replace. Those suffering severe lung disease for example will have a long wait for factory part to take the place of the lungs. However, trials with a 'bridge' for patients awaiting lung transplants have been successful at Seattle's Northwestern University.

The artificial lung can be attached to the artery that connects the heart with the lung. Inside the mechanical lung, which is implanted inside the chest cavity, there are fibres that exchange oxygen for carbon dioxide. In tests, the device has been able to preserve lung function in an animal model for 24 hours.

The new device is a "nice improvement over earlier efforts," says Dr. Larry Schulman, an associate professor of clinical medicine and medical director of lung transplants at the Columbia-Presbyterian Medical Centre in New York.

***About the size** of a 'C' battery, the The Jarvik 2000 is a valveless, electrically powered miniature axial flow pump, that fits directly into the left ventricle and pushes oxygenated blood throughout the body.*
*Above is the titanium turbine that pumps four litres of blood a minute.*

"They've shown that they were able to deliver the full amount of oxygen needed for a resting person – or in this case, a pig," says Schulman. "Other devices have only given partial support." The research to date suggests that a model that can be tested on people is still way off, but it has spawned a potentially useful spin off – an artificial gill. A team of engineers looking into the possibilities of artificial lung membranes realised they could be used to create an artificial gill to take oxygen from seawater.

"The artificial gill is very similar to the artificial lung used in cardiac surgery," says Noriaki Matsuda of Waseda University's Department of Chemical Engineering in Tokyo, who is working on the project. "The idea of artificial gill came from the artificial lung which is widely used in medical treatment because the blood is oxygenated very quickly by using pure oxygen gas. But in an artificial gill the oxygen transfer rate is very small as the concentration of oxygen dissolved in seawater is low and the diffusion rate of oxygen in water is very slow. So we are now studying how to increase the oxygen transfer rate."

A mesh of spaghetti-like hollow fibres with ultra thin surfaces filters out the oxygen molecules for breathing underwater in Matsuda's apparatus. Details of his findings were presented at the meeting of the American Society for artificial organs last April in New York. There are still many problems to overcome he says, but aims to have a experimental lightweight device similar too an aqualung rigged up in the near future.

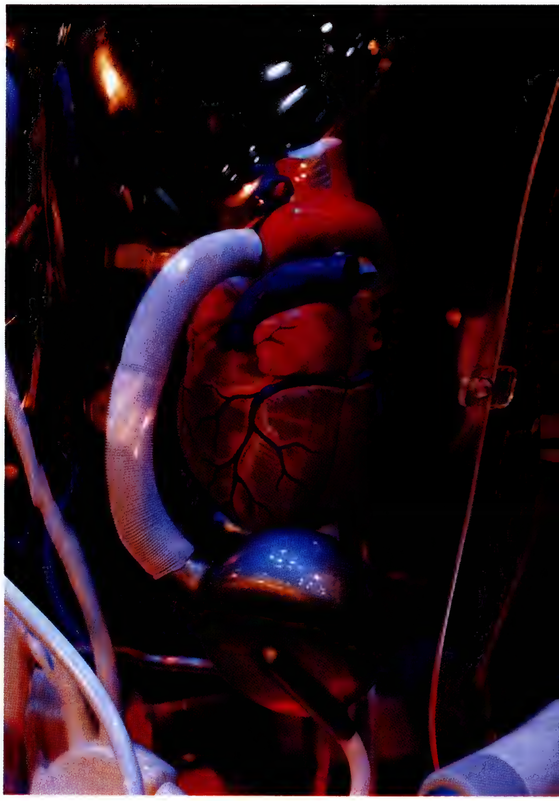
## Rejection issues

Made to be used on the outside of our bodies, the fabricated gill would encounter no problems of compatibility unlike an internally placed artificial organ. Before such organs become commonplace we will have overcome problems of rejection and find the right materials to make them from, say the experts.

One bio-technology answer to the question of how we can replace our failing organs is to grow biological replicas, but that has its own problems says Prof. Colin Humphreys the Goldsmiths' Professor of Materials Science at the University of Cambridge. "We can culture these things biologically, for example by using pig's hearts to replace human hearts. But the problem we have is rejection. You put these things into somebody's body and you get rejection."

Because rejection of foreign live tissue in transplants is a bigger problem than ever dreamed of by the scientists, the future for artificial organs is looking brighter. But if the Achilles heel of test tube parts is compatibility, than that of artificial organs is finding the right materials.

"The materials used are of critical importance. There was a case not so long a go where 3M had artificial hips that were coated with some material, and the coating then came off. That was a disaster. The coating interacted with the bone and ground it down," says Prof. Humphreys.



Whatever the pitfalls of replacing brittle hips, we have come used to the idea of replacing broken ball and sockets since the 60s to the extent that the whole replacement industry is big business. As the proportion of old people in need of repair increases rapidly, more and more of us will be calling out for the necessary spare parts to keep us in the land of the living.

In the short term science is promising, if not an aging population sporting six million dollar bionic enhancements, that it does have the technology, we can rebuild the human body. Well, some parts at least.

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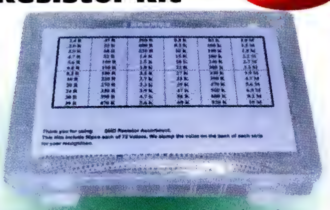

Have that SMD resistor handy when you need it. This kit includes 50 pcs each of 72 values, supplied in a handy plastic storage box. Values supplied are 2.4Ω, 3.0, 3.9, 4.7, 5.6, 6.8, 8.2, 10, 20, 24, 30, 39, 47, 56, 68, 82, 100, 150, 180, 220, 270, 330, 390, 470, 560, 680,820Ω •1.0K, 1.5, 1.8, 2.2, 2.7, 3.3, 3.9, 4.7, 5.6, 6.8, 8.2, 10, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82, 100, 150, 180, 240, 300, 390, 470, 560, 680, 820K •1.0M, 1.5, 1.8, 2.2, 2.7, 3.3, 3.9, 4.7, 5.6, 6.8, 8.2, 10M. TOTAL RESISTORS 3,600. Each resistor strip has the value stamped on the back. Less than 2c / resistor.
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## 60 in 1 Electronic Project Lab

NEW

This is an excellent way to learn about electronics. This kit uses springs to hold the components, and includes components such as resistors, capacitors, transistors, LEDs, Diode, transformer. relay. buzzer, switch, etc. Comes with user manual with 60 projects to build. **Cat. KJ-7026** **$39.95**

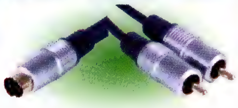
## Sound Synthesizer LAB with Voice Recording / Playback

NEW

This new kit is based around a voice IC chip and allows you to connect circuits together to send, record and play back messages. You can also create alarms that use the sound of your own voice. Springs are used to hold the components. Comes with user manual with 50 projects to build.
**Cat. KJ-7028** **$59.95**

## New Audio Video Lead

NEW



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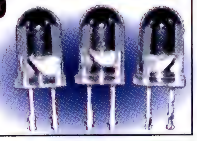

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Current 20mA.
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**$3.95**

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This switch has both 6 pin mini din sockets and D15 high density sockets for input and output for mouse and keyboard. Metal case.
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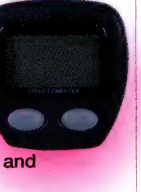

This cycle computer has 7 functions, which are:
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- CLOCKTIME.

Also features automatic start/stop function and power saving function. Supplied with all mounting hardware, which allows the actualcomputer to be removed from its cradle easily, when the bike is left unattended. Clear instructions included.
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## Push Bike Halogen Light

NEW

This halogen light is really bright! It features a 2 mode light level, full light and 1/2 light. Its supplied with handlebar mounting bracket with quick latch so light can be removed. There is a LED in the top, which shows rider light is on. Runs on 4 x AA batteries (not included). Size 120(L) x 65(W) x 45(H)mm. Spare globe 4.8V 500mA SL-3209 $8.95. **Cat. ST-3040** **$29.95**

## Laser Safety Light

NEW

This safety light uses very bright LED's, which are 1000MCD. Visible up to 800 metres. There is 5 red LEDs, and there is six functions - asteady light, slow and fast flashing, 3 different running light patterns. Unit is very small, 59(L) x 34(H) x 25(L)mm and comes complete with belt clip, bike bracket with quick release and elastic arm bracket. It has a gasket for waterproofing and is ideal for many situations where you need to be seen. **Cat. ST-3038** **$9.95**

## Rechargeable Push Bike Halogen Light Kit

NEW

This kit includes the halogen light shown adjacent, a 240V charger and 4 x 1000mA AA Ni-mH batteries. The halogen globe draws 500mA current, so this relates to up to 2 hours light from each charge.
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## NEW KITS for AUGUST

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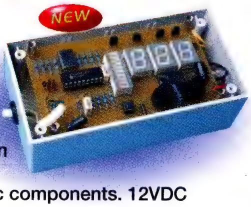
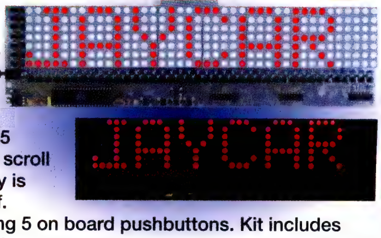


Refer EA July 2000 This handy colour video fader is low cost, easy to build and features a switchable enhancer to compensate for the inevitable video dubbing losses. Manual control allows you to fade to black at your own speed. Kit supplied with case, silk-screened panel, PCB and all electronic components. 12VDC plugpack required -use MP-3002 **Cat. KA-1816** **$45.00**

### RUNNING LED DISPLAY

NEW



Exclusive to Jaycar. This neat running LED display uses eight 7 x 5 red dot matrix displays to scroll up to 511 characters. Features include over 65 different characters, 16 scroll speeds and the memory is maintained at power off. Programmed easily using 5 on board pushbuttons. Kit includes double sided PCB, displays and all electronic components. 12 VDC plugpack required - use MP-3015. Cat. KJ-8720 **$179**

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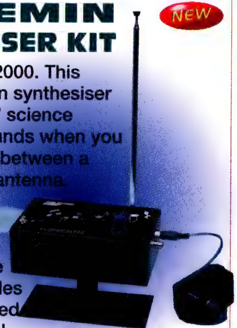


Ref: SC August 2000. This modern Theremin synthesiser produces "eerie" science fiction movie sounds when you move your hand between a metal plate and antenna. Features in-built loudspeaker for practice sessions and line output. Kit includes case, silk screened front panel, metal plate, antenna, speaker and all electronic components. 9-12VDC plugpack required - use MP3007. Cat. KC-5295 **$39.95**

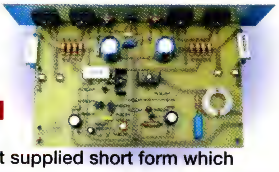
### SPEAKER PROTECTION KIT WITH OPTIONAL HEATSINK FAN CONTROL

NEW

Ref: SC August 2000. This new stereo speaker protector kit provides muting at switch on and switch off to prevent speaker thumps, switches on a cooling fan when the heatsink temp rises above 60°C and cuts out speakers if the heatsink temp rises above 90°C. Kit includes PCB, thermal cutouts, relay & PCB components. Cat. KC-5294 **$34.95**

### 100 WATT ULTRA LOW DISTORTION AMPLIFIER KIT

Heatsink not supplied.



Refer SC March/May 2000 This class AB amplifier delivers up to 100 watts into 8 ohms. Heatsink required - use HH-8530 **Cat. KC-5288** **$89.00**

### COMPACT FLUORO LAMP DRIVER KIT

Refer SC July 2000. Power your 240VAC compact fluorescent lights from a 12V battery! Drives loads up to 40W for CFLs with 0.95 power factor and up to 33W for CFLs with low power factor. Kit supplied with diecast box, silk screened panel and all electronic components. CFLs and fittings not supplied. **Cat. KC-5293** NEW **$79.95**

### POWER SUPPLY KIT FOR LOW DISTORTION AMPLIFIER

Refer SC March/May 2000 Power supply PC board to suit KC-5288 amplifier module. Kit supplied short form which includes PCB and on-board components only. Details supplied in kit for purchasing toroidal transformers. Additional parts required include 4 x RU6710 8000µF capacitors, bridge rectifiers and 240V mains hardware. **Cat. KC-5289** **$29.95**

### AUDIO/VIDEO TRANSMITTER

Transmit audio & video to another room. Range 20mtrs. See Cat. page 7. **Cat. KC-5272** **$38.26**

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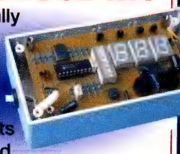

Refer SC June 2000 This fully automatic rain gauge is self clearing and displays up to 61 days of rainfall data on its 3 digit digital display. Kit includes all parts to make the display unit and outside rain gauge. Plastic funnel and 3 core cable required. Needs 9-12VDC use MP-4007. **Cat. KC-5292** **$65**

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### CD AUDIO COMPRESSOR KIT

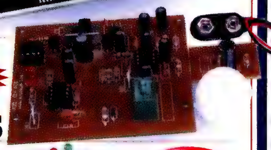
Refer SC June 2000

NEW

Use this compressor to boost the low levels and compress the high levels of your music so it can be better heard in noisy environments including in cars, house parties and restaurants. You can use it "live" or for recording CD's to tape. Kit includes case, silk screened panels and all electronic components. **Cat. KC-5291** **$75**

### Infrared Detector

See Cat P15



Cat. KV-3576 **$21.95**

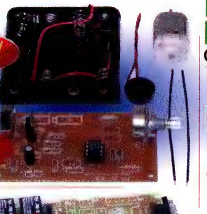
### Crystal Radio

NEW

Cat. KV-3540 **$10.95** See Cat P12

### DC Motor Controller

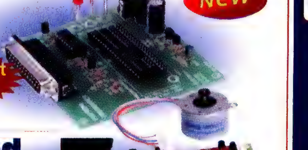
NEW



Cat. KV-3550 **$14.95** See Cat P25

### Serial PIC Programmer Kit

NEW



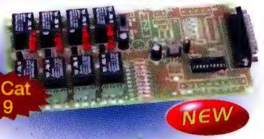
Cat. KD-6062 See Cat P19 **$37.95**

### 007 Earphone Enhanced Detecta-phone

NEW

Cat. KV-3514 See Cat P11 **$44.95**

### PC Link for Automatic Control



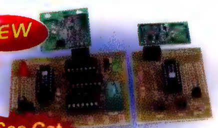
See Cat P19 Cat. KV-3590 **$53.95** NEW

### PC Controlled Stepping Motor

Cat. KV-3594 **$47.95** NEW See Cat P25

### Infrared Motor Controller

NEW



Cat. KV-3554 **$23.95** See Cat P21

### RF Remote Control

Cat. KV-3570 NEW **$43.95** See Cat P21

### Vocal Converter

Cat. KV-3520 **$16.95** NEW See Cat P12

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Cat. MM-2022

**Only $3.50 ea 10+ $3 ea**

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NEW

SPECIFICATIONS: •Nom operating voltage; 12VDC •Speed (no load); 5625rpm •Current (no load); 31mA •Speed (max eff); 4200rpm •Current(Max Eff); 435mA •Torque (max eff); 25gcm •Dia; 24mm •Length; 35mm •Shaft length; 10mm •Shaft dia; 2mm

Cat. YM-2710 **$2.95** LIMITED QUANTITY AVAILABLE

## Bitumen Based Sound Deadener

NEW

This product is a bitumen base with adhesive incorporated, bonded on to alluminium foil. It is designed to be pressed on and into the inside of the outer door skin of a car or other vehicle. It can conform to irregular surfaces. The dense, heavy material deadens resonance and also acts as a barrier for sound, both ways. It sticks well to painted and unpainted steel surfaces. It makes your car quieter inside which not only makes your car more comfortable, your car stereo does not have to work as hard! Has indefinite life. 2 x 300mm square sheets are supplied in a cardboard tube, generally enough to deaden one car door.

Cat. AX-3684 **$19.95 Per Tube**

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NEW

These solonoids, are made made in Japan. They are 6 volt, 10 ohms, have a 10mm movement. Size is 38 x 20 x 25mm. Limited quantity. Less than 1/2 normal price.

**Cat. SS-0908 Only $3.95**

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This is a 90V NE2 Neon fitted with a 250K 1/2W resistor, allowing operation on 240VAC. Cat. SL-2691

**48c ea x10+ 40c ea**

## RJ45 PLUGS FOR SOLID CORE CABLE

NEW

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|---|---|
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**LARGE ILLUMINATED ROCKER**

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Mains illuminated DPST 240V 15A. Orange colour illuminations. Cutout size 28 x 22mm.
Cat. SK-0988 **Special Deal**

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These normally come with a spring, but our supplier sent us ones without. Their loss, your gain. Cable entry size 6mm. **Cat. PP-0117**

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**These are 80¢**
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Our supplier shipped us black boots instead of blue. Their loss your gain. **Cat. PM-1446**

**These are normally $11.95 packet of 50**

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## ATX COMPUTER POWER SUPPLY ON/OFF SWITCH

NEW

Replacement power switch. 250VAC 10A. Complete with connecting cable & 2 pin plug
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|---|---|---|---|---|
| SB-2452 | AA 600mA | 2.15ea | 1.90ea | 1.65ea |
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| SB-2441 | AA 1000mA Solder Tag | 3.59ea | 3.00ea | 2.40ea |
| | | | | Buy 5 |
| SB-2464 | C Size 2.25AH | 6.65ea | 5.50ea | 4.80ea |
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## Colour CCD Camera in Metal Case with Audio

Cat. QC-3483

**Was $235**
**August**
**$209**
**Save $26**

colour

## Wireless B&W CCD Camera System

THIRD EYE

Wireless camera with a range of up to 150mt clear line of site, and up to 60mts indoor. Receiver unit will accomodate up to 4 cameras and switch between them. Includes mains power supplies.

Cat. QC-3445 **Was $573.66**
**August Only $499**
**Extra Cameras** Cat. QC-3448
**Were $382.12 August $339**

## SIREN DRIVER TYPE HORN SPEAKER 200 ONLY

This looks like a high power siren out of an under-bonnet car alarm. Indeed it was used in a popular Australian made car alarm. The manufacturer went broke and sold us these. They do not have siren driver electronics in them. They do, however have a 40WRMS speaker mounted inside an ABS plastic horn type housing. There are two holes in the case for wiring entry, key switches etc. A sturdy metal mounting bracket is also supplied. This speaker is ideal as an indoor or outdoor compact, but high power PA speaker.

**Cat. LA-5260** **$15ea**

**BUY 10 LESS 10%**

## Mini Female Spade Bargain Packs

NEW

Spade width 3.2mm.
Cable entry size 2mm.
Cat. PT-4532 **Pkt 20**
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## Sub C Ni-Cad Battery Bargain

NEW

This is a 1300mA Sub C Ni-Cad Battery. It has standard contacts, not tags. Strictly limited, quantity available. Normal Sub C's with tags are $5.26
Cat. SB-2454
**These are only $3.95 ea**

## IEC Female Chassis Socket

NEW

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## 4PDT Cradle Relay

NEW

Same as our SY-4009 relay in the catalogue except this one has PC pins. Limited quantity. Specs: •Rated voltage; 12VDC •Coil resistance; 180Ω •Contact rating; 3A NO/NC contacts •Size 24 x 21 x 32(H) ecluding pins.Cat. SY-4010
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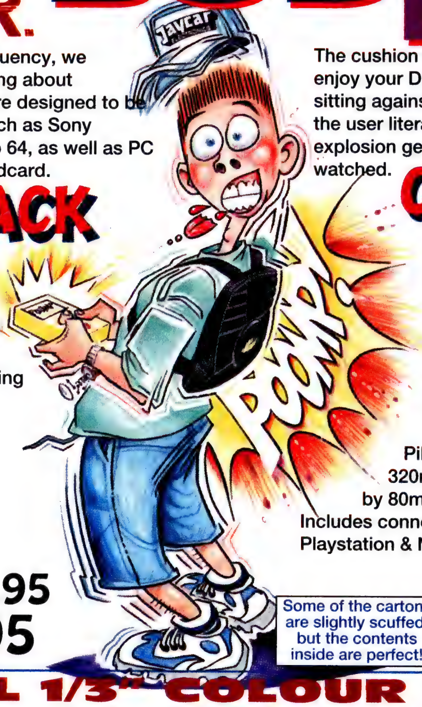

## BACKPACK

The backpack is more suited to games machines for kids as it can be strapped on to their back for walkaround action. The backpack includes connecting leads for the Playstation and N64.

**Cat. XC-1000**

WERE $269 THEN $49.95

**NOW ONLY $29.95**

## CUSHION

The cushion is ideal for home cinema. Simply place one where each person sits, and feel all the action through your back. The cushion is black and won't look out of place in/on most lounges.

Pillow size is approx 320mm wide x 420mm high by 80mm thick at its deepest point. Includes connecting leads for home theatre, TV, Playstation & N64. **Cat. XC-1005**

Some of the cartons are slightly scuffed, but the contents inside are perfect!

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## PROFESSIONAL 1/3" COLOUR CCD CAMERAS

### With Panasonic Sensor, Audio & Auto Iris Option

NEW

This new camera has 420 TV lines resolution. Features include: •PANASONIC 1/3" CCD SENSOR for super high quality and long life •Inbuilt high sensitivity microphone •Will accept auto iris lens or standard C & CS lenses. A quality camera. •Auto iris: Video type / DC type switchable •Microphone: High sensitivity •Power source: DC12V +/-10% •Current consumption: 90mA •110L 60H x50

**Cat. QC-3302**

**$329**

### Dome CCD Camera With Panasonic Chip

NEW

This high quality camera has 420 TV lines resolution, and the 1/3" Panasonic Chip for extremely long life and high reliability. It offers excellent reproduction with low lag and high burn resistance. •Load impedance: 75Ω •Standard board lens: f3.6mm/F2.0 •Lens angle: 92° •Size: 87(Dia)x72 (H)

**Cat. QC-3303** **$329**

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**Cat. SP-0764**

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CONDUCTED BY JIM ROWE

# Confusion is Rife in the electrotherapy industry

As I commented last month, a fair amount of further information has come my way on some of those 'alternative' electrotherapy devices. This month I'm passing on some of these snippets, and I think you'll find them quite interesting. They concern the many devices which are claimed to be based on the work of Royal Raymond Rife.

**BEFORE I START**, though, I would like to offer a brief explanation about my position regarding colloidal silver and the therapeutic claims made for it. You might recall that last month I presented an ACCC release announcing that following a Federal Court injunction obtained by the ACCC, NSW firm Vital Earth Company had agreed to offer refunds to people who had purchased any of its colloidal silver related products. I commented that this seemed like a step forward, but I was puzzled that no action seemed to have been taken regarding the zapper-type devices that *weren't* related to colloidal silver – when to my mind, the claims made about zappers themselves are actually more worrying.

That's still my position. But I noticed in the Autumn 2000 issue of the Australian Skeptics' publication *The Skeptic* a letter from Professor Robin Stokes (an Emeritus Professor of Chemistry) pointing out that silver nitrate and colloidal silver have a long history of medical use as a bactericide, prior to the development of antibiotics. While stressing that he is no supporter of 'magical electronic devices' claiming to produce colloidal silver or anything else, Prof. Stokes wanted to correct any doubts that silver ions do indeed have a strong anti-bacterial action. I suspect he believed that I had expressed such doubts, because he wrote 'I have also seen similar comments in electronics magazines'.

Fair enough. Except that I think Professor Stokes may have misunderstood what I've written about colloidal silver, perhaps because I didn't make it clear enough. For example I wrote in the February 1998 column that colloidal silver is a weak solution of silver ions in water (about 25 parts per million), and has been credited for many years with being a very effective germicide, able to kill all sorts of bacteria when used either internally or externally.

RIFE'S OWN MACHINE DIDN'T ACTUALLY USE ANY DIRECT CONNECTION TO THE PATIENT

I was also aware, but didn't spell it out at the time, that silver nitrate drops had been used for many years in maternity hospitals to protect the eyes of newborn babies against infection from sexually transmitted diseases and the consequent risk of blindness – and apparently quite effectively, too. Silver nitrate crystals were also used in the topical treatment of warts and other skin infections, although in this kind of very high concentration the silver ions can apparently burn and corrode healthy skin as well.

So there's no argument that silver ions in one form or another do seem to have a strong antibacterial action, and Professor Stokes is right to remind us of this.

However that doesn't change the fact that many of the modern proponents of colloidal silver have gone far beyond claiming it as a good anti-bacterial agent, and made all manner of way-out and unsubstantiated claims about it, as well as forgetting to mention the risks associated with its use.

For example you'll recall that the ACCC said Vital Earth claimed that it had *no* harmful side effects; that it's effective in treating 650 different pathogenic bacteria and virus types; and that it has been used successfully against diseases including AIDS, cholera, diabetes, leprosy, leukemia, lupus, skin cancer, syphilis and whooping cough. All of which the ACCC believed were unsubstantiated and misleading.

Basically that's my position too. Colloidal silver might be very effective as an anti-bacterial agent, but claiming anything more than that is currently verging on deception – and I'm delighted that the ACCC has been been able to jump on at least one firm which did so.

## Confusion Rife

I haven't actually written much about these before, but you may recall that back in January 1998 I mentioned that one complete class of electrotherapy device seemed to have evolved from the work of a US researcher named Royal Raymond Rife, who claimed in 1932 to have discovered a 'virus' responsible for cancer. He went on to develop a device which he claimed cured cancer and other diseases by exposing the viruses, bacteria and other responsible agents to electronic or electromagnetic signals 'tuned' to what he said were their specific resonant frequencies – which he called their Mortal Oscillatory Rates (MORs).

Many of the latter-day devices which claim to be based on the work of Rife quote these MORs as frequencies in the audio range: 2008Hz (or 2128Hz; authorities differ) for cancer, 2167Hz for leukemia, 55Hz for glandular fever and so on. In fact the largest group of the Rife-type machines seems to be little more than pulse generators designed to deliver signals on one or another, or combinations of these audio MORs, and deliver them to the patient via metal electrodes.

For example the 'manual' which our correspondent Cheryl was finally able to extract from Mr Braham's Queensland firm Exclusive Products for *their* particular Rife-type machine lists some 50 available frequencies, ranging from 0.67Hz up to 10.0kHz, and gives 5-1/2 pages of listings showing which frequencies are to be used to treat which disease or ailment – from appendicitis, AIDS, cancer, leprosy and gonorrhoea through to dandruff, athlete's foot and insomnia.

All of which seems to be based, as far as I've been able to learn, on Rife's belief that if you find a biological cell's resonant frequency and somehow energise it strongly enough at that frequency, it will absorb enough energy to ensure its destruction. And he believed that with the aid of a special super-microscope he had invented, he'd been able to discover the correct frequencies to destroy the cells of all major bacteria and viruses responsible for human suffering: the MORs.

Many of those promoting devices based on his work relate the story that Rife's claims were thoroughly investigated by a committee of medical researchers and physicians at the University of Southern California in 1934, which supposedly found much of what he claimed to be true – even with regard to curing cancer. However they claim that Rife was then the victim of a huge conspiracy – presumably by the big international pharmaceutical firms, who supposedly didn't *want* diseases like cancer to be cured.

Whether there's any truth in this I have no idea, but one way or another his equipment and original notes were apparently lost or destroyed, like all records of the USC committee findings, and he died a bitter and broken man in 1971.

So it isn't easy to refer back to Rife's own work. But some of the other information I've come across (much of it very kindly drawn to my attention by the ever-vigilant nurse Cheryl) does throw some light on this area -- but turns out to confuse things all the more.

For example there were a couple of articles about Rife and his devices published in the Queensland published magazine *Nexus* in 1998 (February-March and April-May issues), written by James E. Bare. Dr Bare is a Doctor of Chiropractic who lives in Albuquerque, New Mexico (USA) and has apparently been practising there for over 20 years. He also seems to have developed what he claims is a 'modern and updated' version of Rife's original therapy device, and sells books and videotapes describing its construction and use for anyone wanting to build and use one. Apparently his design has become widely known as the Rife-Bare machine, and so many have been built that they form a major strand of the devices claiming to be derived from Rife's work.

Now the interesting thing is that in the *Nexus* articles, Dr Bare writes that Rife's own machine didn't actually use audio frequencies at all; nor did it use any direct connection to the patient via metal electrodes. Instead, he claims it used much higher RF (radio frequency) energy, fed into a high voltage discharge tube which was passed over the patient a short distance from them...

According to Bare, for example, Rife gave the MOR for cancer as 28.825455MHz – up in the upper shortwave region, and an electromagnetic world away from the modest 2008Hz or 2128Hz audio frequencies usually quoted as gospel by those flogging many modern-day 'Rife' machines.

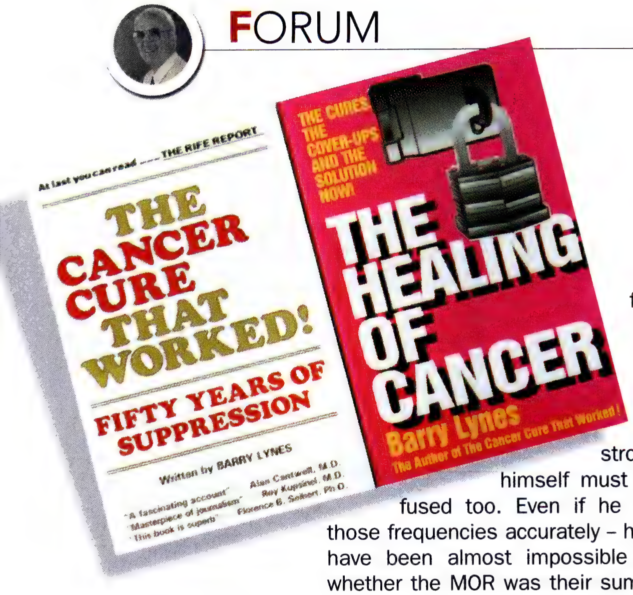
In another place, Bare admits that the situation is complicated because Rife's machine actually heterodyned *two* frequencies together in the final stage of his 'beam ray unit'. And *both* frequencies were supposedly varied to achieve the specific MORs for different diseases, just to make it really confusing.

For example to treat carcinoma, he says Rife used a combination of 11.780MHz and 17.045455MHz – so the actual MOR might have been either their sum (28.825455MHz) or their difference (5.265455MHz). Now exactly how Dr Rife, for all his supposed genius, could even measure radio frequencies to anything like this order of accuracy back in the early 1930s I can't imagine. Frankly I doubt whether the US Bureau of Standards could have been *that* confident of measuring frequencies at the time, let alone the struggling Dr Rife beavering away in his private lab.

But even if we *do* give him the benefit of the doubt in that regard, it still throws the whole idea of MORs into great confusion, surely. Because even if we're prepared to admit the possibility of treating nasty bacteria and viruses by zapping them at the specific resonant frequencies of their cells, that still implies that the cells *do* have such a specific resonant frequency – and that they've been found, of course.

Are those resonant frequencies in the audio region, though, as many of those who flog modern 'Rife' boxes claim, or are they in the RF region as Dr Bare claims were found and used by Rife himself? Dr Bare's own design, which forms the basis for the so-called Rife-Bare machines apparently uses a fixed RF carrier of 27.12MHz, pulse modulated at frequencies varying from 160Hz to about 20kHz. The signal is generated in a modified CB transceiver, boosted in a linear amplifier and then fed via an 'antenna tuner' matching network to an argon/neon (80%:20%) plasma tube as the antenna. (It apparently glows a nice mauve, which said to produce the 'most beneficial overall physiological effects', and 'has also been shown to be the most destructive to cancer cells'...)

***One type*** *of 'personal' electrotherapy machine being sold in Australia, by AFT. Although supposedly based on the work of Rife, it uses audio frequency tones. (Courtesy Barry Williams, Australian Skeptics Inc.)*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Barry Lynes
The Author of The Cancer Cure That Worked!

***These two books*** *by US author Barry Lynes are used widely by the 'alternative electrotherapy' industry to boost its credibility. Yet in the latest edition of The Healing Of Cancer, Lynes admits that many 'Rife' machines are dangerous fakes. (Courtesy 'Nurse Cheryl')*

It's all quite a confusing mess, in other words, and frankly from what Dr Bare has revealed about Rife's original machine I have a strong suspicion that Rife himself must have been quite confused too. Even if he could have measured those frequencies accurately – highly unlikely – it would have been almost impossible for him to work out whether the MOR was their sum or difference in each case. Let alone being able to prove they were the MOR for only the cells of the bacterium or virus concerned, and not one that killed other healthy cells in the patient...

Talk about whistling in the dark! And of course even if Rife had managed to fluke a few frequencies in the RF region which were beneficial in treating certain diseases, that does nothing whatever to justify those long tables of specific audio frequencies which are given by many firms now selling audio pulse generators as 'Rife' machines. Where on earth did they get *their* frequencies from, and where's the evidence that these much lower frequencies work? (Which would probably amount to evidence that Rife's radio frequencies *didn't*...)

And what about the major difference in delivering this energy to the patient – how did Rife's system of using a high-voltage discharge tube as a kind of 'plasma antenna', somehow get changed into feeding small currents directly through the patient via metal electrodes?

Frankly it's hard not to believe that the lower frequencies have been taken up mainly because they're a lot easier to generate than the radio frequencies used by Rife himself. Similarly feeding them through the patient via metal electrodes is far less likely to generate EM interference than a high-voltage plasma antenna, and therefore much less likely to arouse the attention of authorities like the ACA, concerned with ensuring electromagnetic compatibility.

Sorry if that explanation sounds pretty cynical, but I really think it's the most likely one. Especially as I'm not the only one who seems to have come to this conclusion. In fact support for it actually comes from a surprising source...

## Lynes' denunciation

US author Barry Lynes is author of the two books which are most often used by the 'alternative electrotherapy' industry to boost the credibility of their devices: *The Cancer Cure That Worked!*, which relates the story of Raymond Rife and the conspiracy theory surrounding his work, and *The Healing Of Cancer*, which follows on and discusses the overall alternative medicine scene and how its 'cancer cures' have supposedly been suppressed by vested interests.

So on the surface at least, Lynes is the champion of alternative electrotherapy in general and the work of Rife in particular – and hence a much-used reference by those flogging 'Rife-based' magic boxes. But I'm very grateful to nurse Cheryl for drawing to my attention a most interesting appendix which Lynes seems to have added to the latest edition of his second book *The Healing Of Cancer*. Titled 'Appendix G: The Exploiters', it seems to be a rather angry and embarrassed denunciation of most of the alternative electrotherapy industry, and the way it has exploited desperately ill people while using his books to boost their own credibility.

He makes no bones about the way these exploiters have simply claimed that their 'black boxes' were 'Rife instruments' or improvements on the work of Rife and other early inventors, to make quick profits by giving desperate and near-destitute people the impression that their cancers could be cured effortlessly and painlessly.

He also denounces the "*engineers, doctors and companies which endorsed the black boxes or produced them while 'making no claims', yet using the name Rife in their advertising literature.*"

Lynes then goes on to note that as a result of this exploitation, many seriously ill people have lost precious time "*before recognising that they had been swindled in a clever marketing scheme. People died because they had faithfully used the worthless black boxes instead of orthodox or alternative, non-conventional cancer therapies which actually worked.*"

Further on Lynes notes that "*Still another exploiter purchased an over-the-counter frequency generator for $200, attached a plate with the name 'Rife' to the generator and then, presto!, proceeded to sell the generator for $2000. Even though the foreign manufacturer warned 'Do not use for human beings, dangerous', the man continued to sell them. His written justification? He had the right to make a profit and 'had nothing to lose'. But his clients sure did.*"

(This sounds like one of the Australian firms, doesn't it?)

Mr Lynes adds that "*Law enforcement officials are investigating a number of these exploiters. Hopefully the worst offenders will be jailed for the serious crimes they have committed against their neighbours.*"

He ends up with a warning that anyone who is contemplating the purchase of a black box that is being promoted as a Rife Frequency Generator, or otherwise attributed to or based on the work of Rife, should insist on documentation from at least five cancer patients testifying that they have been cured by the so-called wonder device.

This is coming from an author who still clearly believes that Rife himself did discover the cure for cancers, and that Rife's own original machine did work. But it's hardly a glowing endorsement of the many so-called Rife machines being flogged using his books as a reference, is it?

The real mystery to me is why the ACCC doesn't seem to be particularly concerned about these devices (and the Clark-type '555-in-a-box zappers', which are a kind of el-cheapo version of the 'audio Rife' machines) -- or at least not as concerned about them as colloidal silver gizmos. Strange, don't you think? ea

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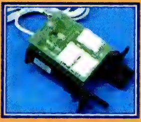

The module is ideal for a wide range of applications, including vending machines, gaming, ATM transactions, security access system, electronic wallet systems & customer data management systems. It uses a ddm 862-hybrid card acceptor that has one push-pull magnetic card reader and one chip card connector. The magnetic card reader is standard with dual track 2/3. The unit comes standard with one User IC Card and 3 SAM card acceptors.

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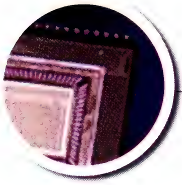


# SILICON VALLEY

NEWS

## IN BRIEF

■ In future your alarm clock will not only wake you up in the morning, but will also start brewing a pot of coffee in the kitchen and turn on the heater in the winter.

Sun Microsystems announced it is further expanding its cooperation with home appliance maker Sunbeam to link appliances in a home. The networked appliances will run under control of Sunbeam's 'Thalia Products' group, which develops software that allows household devices to be connected and programmed to work together.

■ Today's hard disk drives can store so much information, and in so much better quality than magnetic tape based media, that consumer electronics companies are beginning to use hard drives for a new generation of recording devices.

Earlier this year, Creative Strategies said it was planning a 'Nomad' device that could store 100 hours of music in a hard drive no larger than a portable CD player.

Now Sony and Matsushita say they have developed new home audio and video systems that use hard disk drives as a recording medium. They include a hard-disk video recorder which can capture as many as 15 hours of TV broadcasts, and transfer the images onto digital video discs. The machine will retail for about US$1800.

■ The recall by Intel of tens of thousands of faulty PC computer motherboards (as reported in last month's Silicon Valley News) is expected to cost the company a cool US$253 million.

## TI buys Burr-Brown for $7.6 billion

**TEXAS INSTRUMENTS HAS** agreed to pay US$7.6 billion for Burr-Brown, a long established manufacturer of data converter and amplifier analog semiconductors. The takeover is an all-stock transaction in which Burr-Brown shareholders receive a healthy 56% premium over the current value of their stock.

"What this does is position TI from being No.5 in data converters to where we become No.2", said Rich Templeton, TI's chief operating officer.

Burr-Brown CEO Syrus Madavi said the two companies make a good fit. Burr-Brown's integrated circuits and other products are used in personal computers, medical instruments, industrial controls and communications devices. "We have a common view of the market and complementary skills."

The Semiconductor Industry Association estimates that sales of analog devices will grow 25% this year to US$22 billion.

Texas Instruments chief financial officer William Aylesworth said Burr-Brown and other recent acquisitions of analog-technology companies will complement TI's leadership in digital signal processor chips. "Every time a device like a cell phone uses a DSP to process data, it also needs analog chips to convert analog to digital and back and to amplify the signal. These are areas where Burr-Brown is a clear leader."

Burr-Brown employs some 1500 people at facilities in Tucson (Arizona), Scotland and Japan. The company earned US$45.7 million on sales of $291.5 million last year.

The Burr-Brown acquisition follows two other analog-related deals TI has made in the past year, including Unitrode, a maker of chips that extend a cell phone's battery life. TI acquired that company last October for US$1.25 billion. And in November, it bought Power Trends for about US$145 million in stock. Power Trends makes chips that monitor a phone's power consumption.

## Lucent to spin off its IC group

**LUCENT TECHNOLOGIES'** Microelectronics division is a US$3 billion-a-year global supplier of semiconductors, lasers and other optical components. Lucent has reportedly decided to spin off the group into a new independent company, a deal that could net Lucent some $40 billion.

An independent Lucent Microelectronics would continue to supply Lucent and also be in a better position to leverage its technology to explore new markets and aggressively pursue a broader customer base, including Lucent competitors such as Cisco and Nortel.

The separation of the components group has been expected and has been advocated by market analysts for several years. Besides leaving the unit free to fully exploit its market potential, the move would enable Lucent managers to better focus on their primary market as the company faces increased competition from Cisco across a broad spectrum of product segments. The latter has flourished without a components group, analysts point out.

## Iridium satellites stay up in orbit

**IRIDIUM'S US$6 BILLION** constellation of 66 communications satellites is still in orbit, and the bankrupt company has pleaded with the court to allow it to accept a $50 million offer from merchant bank Castle Harlan.

If the court rejects the offer, Iridium will probably have to send its satellites into an orbit that will cause them to burn up in the atmosphere.

"Castle Harlan came at a time when no other bids were on the table. The bid is a fraction of what the system costs, but substantially higher than the individual asset bids", Iridium attorney William Perlstein told the US Bankruptcy Court .

Castle Harlan has offered to pay $50 million for the satellite telephone company, plus a 5% equity interest in the new company to Iridium's creditors. Castle Harlan has been investing US$200,000 a month to fund Iridium's operations. It will increase the commitment to $900,000 if its bid is approved.

## IBM to make optical IC chips

**IBM HAS MOVED TO** further leverage its sophisticated contract semiconductor manufacturing capabilities with a strategic partnership with Multilink Technology. The two firms will be developing new components for fibre-optic networking equipment, which integrates voice and data traffic over fibre-optic cables.

Under the terms of the deal, IBM is purchasing a minority stake in Multilink, a Somerset, New Jersey maker of circuit boards for high-speed networking and telecommunications equipment.

Analysts said the move is part of IBM's efforts to target a broad range of IC markets, from high-end microprocessors, such as the Transmeta and Alpha processor, to highly profitable communications ICs.

IBM will produce the new chips, which use a silicon-germanium based design and production process. The market for fibre-optic components is forecast to grow from around US$7 billion to $23.1 billion in 2003. **ea**

# Big G's business tips, and valve amp designs

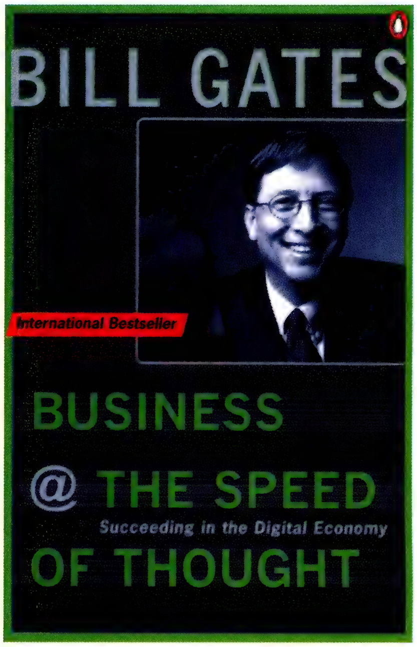
## APPLYING IT EFFECTIVELY

**BUSINESS @ THE SPEED OF THOUGHT, *by Bill Gates. Published by Penguin, soft covers ISBN 0-14-028312-9. RRP $19.95.***

■ *Business @ the Speed of Thought* is not so much a how-to book on using IT to run a business as efficiently as possible, but about developing an attitude towards technology so small business owners and larger business managers can plot their own route to applying IT. The 500+ pages are replete with detail and examples of how businesses can focus on their core competency by removing much of the administrative hassle, repetitive monkey work and time-wasting paper-based forms with a well-thought-out IT system.

*BATSOT* is an informative read with numerous how-to revelations on how to use information technology – in the most catholic sense – in business. Gates mainly uses very big business in his examples – General Motors, Xerox, Ford, IBM, Johnson & Johnson, and, of course, Microsoft – but what he preaches could be effectively applied to smaller businesses. In fact SMEs could probably realise just as much benefit from applying his methodology than larger business – if not more, since small business managers have less systems inertia and efficiency improvements translate to improvements in the bottom line more quickly.

Unfortunately, the book is a bit of a slog. It has all the personality of little Johnnie Howard – like the other books from Gates, it has been run through the PR mill until it is completely bland-ified (a Microsoft PR flack, Colin Hemingway, is given prominent credit for helping to "synthesize" the book). After about 20 minutes, I had to take breaks from reading – Gates' self-righteous preaching and goody-goody attitude is too much to tolerate for any length of time. That's a shame, because he does have a valid message. (Jake Kennedy)



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## CLASSIC AMP DESIGNS

**AUDIO AMATEUR POWER AMP PROJECTS, *as featured in Audio Amateur Magazine from 1970-1989. Published by Audio Amateur Publications Inc., 1996. Soft covers, 280 x 218mm, 207 pages. ISBN 1-882580-08-7. RRP $49.50 ($45.00 plus GST).***

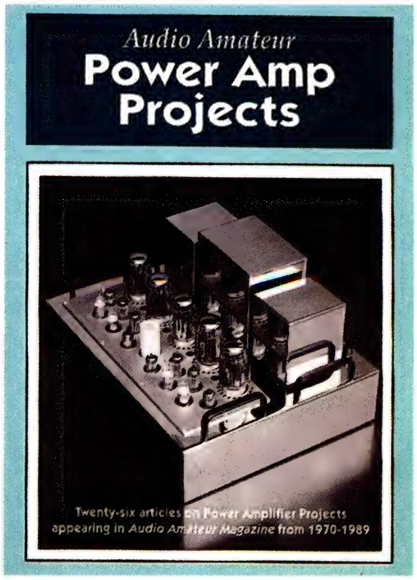
■ US magazine *Audio Amateur* has long been a source of authoritative but down-to-earth information for audio enthusiasts, as testified by this reprint of some of the classic amplifier designs which appeared on their pages over the 20-year period from 1970 to 1989.

It provides some 26 articles, which presented amplifier designs ranging from all-valves through valve/solid state hybrids to all-MOSFET monsters with outputs up to 500W. There's the Bailey 30-30, the Landers Super Brute, the Audio Research revamp of the Dynaco Stereo 70, Reg Williamson's 40/40, and various milestone designs by Nelson Pass, Erno Borbely, Johannes Didden and H.J. Heckert.

Apart from the covers it's all in black and white, and some of the earlier articles are a bit scruffy looking with soupy photos and typewritten text. But the information is all there, and for anyone who wants to try their hand at recreating any of these classic designs it would be a veritable goldmine.

You won't be able to find any kits for these designs, and some of the parts might be quite hard to find nowadays. But for those who enjoy a challenge, building one of these monsters would certainly give you a strong taste of old-time electronics construction.

The review copy came from Jaycar Electronics, who have the book in their stores as Cat. No. BA-1418. (J.R.)


Audio Amateur
Power Amp Projects
Twenty-six articles on Power Amplifier Projects appearing in Audio Amateur Magazine from 1970-1989

# Simulating Silicon Temperature Sensors

Circuit simulators are a very important part of today's electronic design. But these simulations are only as accurate as the models of the components they are simulating. While there are many thousands of component models out there, you sometimes have to bite the bullet and design your own – Alexander Ehle* shows us how.

**IN MANY** circuit designs there is often a need to measure temperature, pressure or humidity. If, as with many larger or complex projects, the circuit is to be simulated as a part of the design process, there is a need for accurate and comprehensive SPICE models of these sensors.

Talk to most engineers though, and you'll find that the reality is that these simulation models are very rare. If the designer is lucky, the available libraries contain a type of sensor similar to the ones used in the design, but there are thousands of different temperature sensors available from various manufacturers, and so the designer is usually forced to either adapt an existing model, or design their own from scratch.

Creating an accurate model takes a lot of experience and time. To ease that work, the following article describes the modeling of a silicon temperature sensor, also known as a *silistor.*

## The silistor

The silistor is a thermally sensitive silicon resistor, with a positive temperature coefficient between -60°C up to +150°C. From 150°C to 260°C the temperature coefficient is negative, but this is beyond the regular working area of the silistor and therefore we can ignore it. Typical applications of silistors are temperature compensation of semiconductor components and circuits.

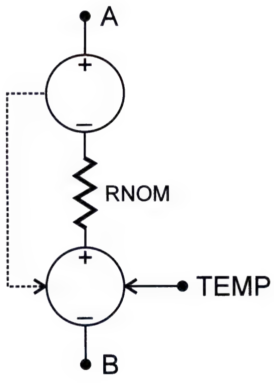
Over the range of -60°C up to +150°C the silistor's behavior can be described with the following equation:

$$R = R_{25} \cdot \left( \frac{273.15 + T}{298} \right)$$

T = Temperature °C
TEX = Exponent (typically 2.3)
$R_{25}$ = Resistance of Silistor at 25°C

The silistor's value also depends on its power dissipation. This dependence can be approximated as follows:

**$R = R_Z$*(1+0.7*P)**, where P is power, and $R_Z$ is the resistance at zero power.



In the SPICE model, the silistor subcircuit is built up with a basic design which allows us to create what is essentially a voltage controlled resistor. A nonlinear controlled voltage source in series with a resistor, with a nominal resistance at 25°C does the job. The zero DC voltage source is used for measuring the current through the silistor.

To control the 'temperature' of the sensor, it is simply best to use an equivalent voltage (e.g. 1V = 1°C). In this example, the temperature control is connected to the third pin (TEMP) of the subcircuit.

For SPICE3F5 and compatible simulators, the following subcircuit can be used:

```
.SUBCKT SILISTOR 1 2 3
* TERMINALS:     A B TEMP
*
V1 1 4 DC 0
R1 4 5 RNOM
B1 5 2 V=I(V1)*(RNOM*((273.15+V(3))
   /298)^TEX)*(1+0.7*(I(V1)*V(1,2)))
.ENDS
```

For RNOM, insert the resistance value at 25°C for the appropriate silistor type. The fitting parameter (TEX) can be kept at 2.3 and if necessary adjusted for matching the sensor's real characteristics.

Pspice uses different commands for the nonlinear source compared with the original Berkeley SPICE3F5. If you are using Pspice, the necessary modifications are easy and are restricted to the third line of the netlist:

```
E1 5 2 VALUE={I(V1)*(RNOM*(273.15+V(3))
    /298)^TEX)*(1+0.7*(I(V1)*V(1,2)))}
```

The complete subcircuit should look like the following one:

```
.SUBCKT SILISTOR 1 2 3
* TERMINALS:     A B TEMP
*
V1 1 4 DC 0
R1 4 5 RNOM
B1 5 2
VALUE={I(V1)*(RNOM*((273.15+V(3))/298)**
   TEX)*(1+0.7*(I(V1)*V(1,2)))}
.ENDS
```

## Temperature variables

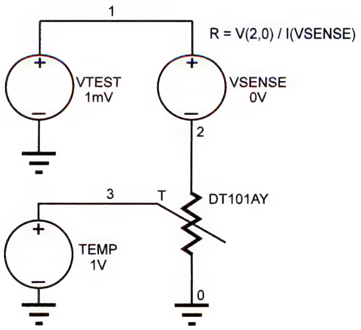
Intusoft-Spice (ICAP/4) supports a temperature variable which can be used within the equation of the nonlinear controlled sources. With this simulator, you can replace V(3) with the variable name TEMP and remove pin 3 from the subcircuit header.

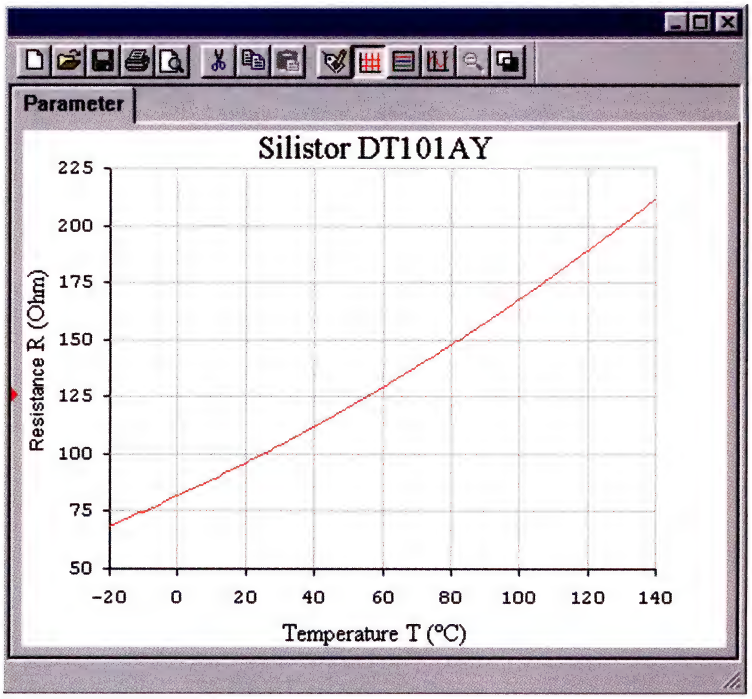
```
.SUBCKT SILISTOR 1 2
* TERMINALS:     A B
*
V1 1 4 DC 0
R1 4 5 RNOM
B1 5 2
V=I(V1)*(RNOM*((273.15+TEMP))/298)^2.3)*
   (1+0.7*(I(V1)*V(1,2)))
.ENDS
```

As an alternative, the enhanced modeling behavior of ICAP/4 can be used to simplify the macro. Using its nonlinear controlled resistor can reduce the subcircuit to:

```
.SUBCKT SILISTOR 1 2
* TERMINALS:     A B
*
V1 1 3 DC 0
R1 3 2
R=(RNOM*((273.15+TEMP))/298)^2.3)*(1+0.7
   *(I(V1)*V(1,2)))
.ENDS
```

To verify the model, you can use a simple test circuit as shown below:





The voltage source TEMP can be changed in discrete steps by using the sweep analysis of your simulator. For the sweep and the displayed voltage value we assume that 1V = 1°C. The nonlinear source is used to measure the resistance by using Ohm's law. The plot above shows the simulation results for the DT101AY of Keystone Thermometrics (**www.thermometrics.com**).

To simplify these types of subcircuits, it would be a simple task for simulator manufacturers to add an environment variable like TEMP (temperature) for use in nonlinear controlled sources. For sensor modeling it isn't that important, because the sensor itself and the circuit are not affected by the same temperature. In any case, with most designs it is quite satisfactory to simulate the temperature with a variable by a voltage source as shown in this article.

## Literature:

- *NTC PTC Thermistors Databook 1993*, Keystone Thermometrics
- *SPICE3F5 user manual*, University of California, Berkeley
- *PSPICE Reference Manual*, Cadence/Orcad
- *Electronics Workbench Users Guide*, Interactive Image Technologies Ltd.
- *EDALIB V4 Users Guide*, 1999, CPSoft

**Alexander Ehle is technical director at Electronics Workbench GmbH for the product Multisim in the German speaking countries. He has more than 10 years experience in electronic circuit development and simulation.*

*Alexander holds a technician's degree in electronics for chemical an physical measurement and studied at the Institute of Electronics, Fachhochschule Reutlingen, Germany.*

*He can be contacted via email at:* ***support@multisim.de***

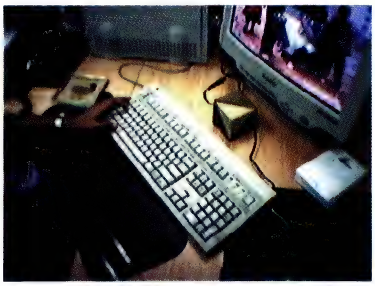
# I spy with my little eye

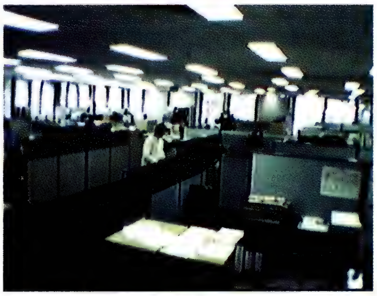
Who goes there? Get a SpyCam and find out! **By Graham Cattley**

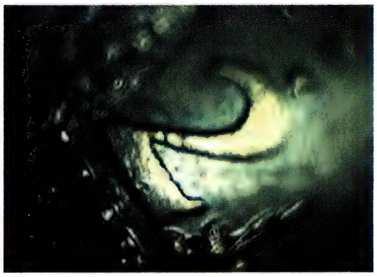
**NOT THAT LONG AGO**, I reviewed what I felt was the smallest video camera I'd ever seen. It had a fairly low resolution and was black and white, but it was the *size* of the thing that had us all excited. At only 35mm square, the thing was tiny!

Well, imagine our reaction when the Swann Spycam landed on our desks here at EA. Not only was it a full colour, full resolution video camera, but it was *smaller* than anything we'd seen before. Just 20 x 20mm square, and 18mm deep, with a thin, figure-8 lead carrying the power and video signals. It was only a matter of minutes before we had the thing plugged into a video monitor and were making fools of ourselves in front of everyone else in the office by smiling, waving and otherwise playing around in front of what looked to be a small, black sugar cube.

As you can imagine, it wasn't long before staff from other magazines were peering over the partitions to see what all the fuss was about. Their reactions were a mixture of surprise, and concern that such devices were available. As was demonstrated by our somewhat outgoing Production Editor, the Spycam could easily become a sneakercam, hatcam or lapelcam, simply by secreting it in appropriate pieces of clothing. It could also be lowered over the partition into another magazine without their knowledge, and used to check that they were working at least as hard as we were...







## A closer look

Once all the excitement had died down though, it was time for some more objective testing.

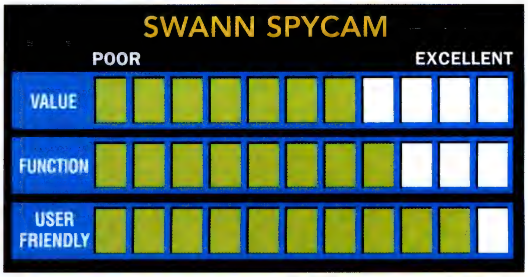
The Spycam produces standard PAL video, and plugs straight into the A/V input of any TV or VCR. Being so small, the camera can easily be mounted in or behind a ceiling panel or wall, with just a 4mm hole needed for the camera's pinhole lens to see through.

Focus is adjusted by sticking your thumb over the lens and screwing it in or out – crude but effective. The range of focus is quite impressive, as you can see, with the close-up of the coin taken at around 15mm, while other shots of the office are quite clear. There is also little evidence of distortion on the long distance shots, which you tend to get with pinhole lenses, giving curved walls and ceilings.

The camera runs off 5V, supplied by the plugpack included with the camera, which also comes with an RCA gender-bender and user's manual. Actually, this manual is a bit of a joke as it doesn't tell you anything useful, but as the camera is so simple to use you won't need it.

The manual does suggest some mounting ideas for it though, including sewing it into the eye of a teddy bear (Nannycam?), or spying through the eye of your Mona Lisa – it all depends on what it is you want to watch I suppose...

Whatever it is, I'd suggest that it be reasonably well lighted, as everything tends to go a rather drab green in low light levels. Apart from that, the Spycam gets the thumbs up from us here at EA, and at the price, it wins on novelty value alone. **ea**



SUMMARY

- A miniature, colour, PAL video camera.

KEY FEATURES

- Well, it's small...

PROS

- Wide range of focus available
- Little distortion of image
- Small
- Cheap
- Comes with everything you need.
- Works well
- Doesn't do well in low light.

CONS

- Could be put to various nefarious purposes...

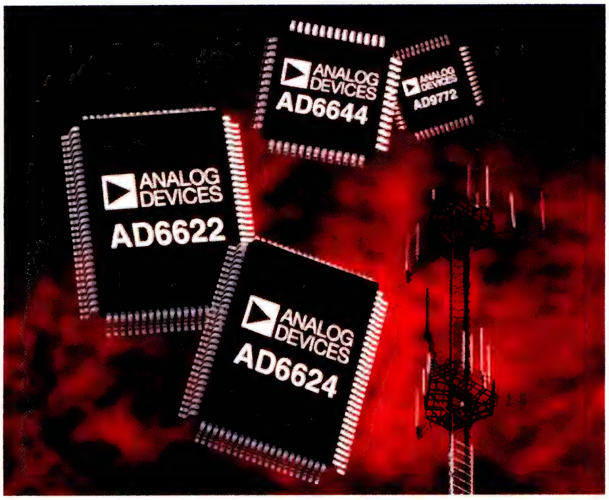
RRP

- 159.95

AVAILABLE

- Harvey Norman, Myer, Grace Bros, Tandy and Electronic Boutique stores.

# Software radios now a reality



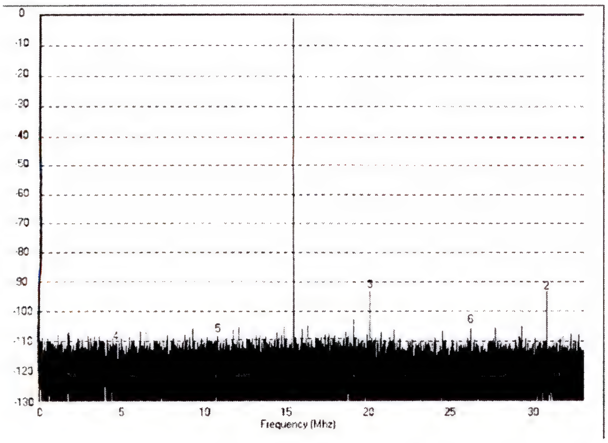
**ANALOG DEVICES** have just announced the availability of the industry's highest performance ADC (analogue-to-digital converter) that is enabling the next generation of communications equipment, most notably programmable digital radio receivers, popularly known as software radios.

The AD6644 is a 14-bit, 65 MSPS ADC that can accurately convert wide band analogue signals (200MHz input bandwidth) with low noise (74dB) and distortion (100dB SFDR), making possible a new receiver architecture that will deliver enhanced voice and data services over cellular and PCS bands. The AD6644 is a critical component of ADI's recently announced SoftCell multi-carrier transceiver chip set.

"One huge challenge for cellular and PCS operators today is staying ahead of consumer demand for more capacity and added features like email, video, and other data-intensive services," said Scott Behrhorst, Analog Devices marketing and applications manager. "The DSP-intensive radios needed to deliver these services will require high-speed, high-resolution ADCs with wide bandwidth, high dynamic range, and low noise."

Because the performance of the AD6644 will allow highly complex functions such as filtering to be performed digitally — thus eliminating the expensive analogue filters that require adjustment during the system manufacturing process — software radios using the AD6644 will be smaller and less costly to manufacture, as well as being easily reprogrammed and reconfigured for new air standards services. In short, cellular/PCS operators can install equipment that will accommodate changing air standards without requiring new hardware — which means an increased return for their investment.

The AD6644 comes in a 52-pin LQFP (Thin Plastic Quad Flat Pack) package and costs just $39.00 in 1,000-piece quantities. More information on this and other high-performance converters, including application and design notes, white papers, and handy selection tables, can be found at **www.analog.com/fastadcs.** ea



***This spectral*** *response plot shows 15.5MHz input frequency at 65Ms/S encoding rate.*

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*Thanks to all our customers who contributed ideas and suggestions for the new 2000/2001 catalogue. I think you will agree the result is outstanding. Also, you may like to explore our new "Virtual Store" at www.altronics.com.au which offers these specials and more 24 hours a day! To celebrate the launch of our new site all purchases over $100 made via the internet site will include a bonus $10.00 gift voucher for you to use with your next purchase with us.*

**Jack O'Donnell, Managing Director**

**If you have not received your FREE copy of the New Altronics 2000/ 2001 Electronics Catalogue you are missing out on a World of Exciting new products...**

**•260 pages •Hundreds of exciting new products •New format •Improved specifications and data • New price scheme ; the more you buy, the more you save**

To receive your *FREE* copy of the 2000/2001 Altronics catalogue e-mail us at catalogue@altronics.com.au or phone 1-800 999 007

## Video Door Phone Intercom

No need to ever open your door to strangers again!

This intercom allows you to see and listen to whoever is knocking at your door before you open your home to them.

*Features:*

- Simple to install
- Includes CCD camera with IR illumination
- Camera activates as soon as the doorbell is pushed.
- Two way communication is possible through the telephone hand set and microphone.
- Camera and monitor can be up to 100m apart (15m lead supplied)
- Tamper switch on the camera unit is compatible with most security systems
- Monitor may operate an electric door strike (S 5385) so you can "buzz" your visitors in.
- Includes 18V DC Plugpack.

S 9400 Only **$399**

## Security Door Strike

Suits S 9400 Video Intercom System

Install this door strike as a gate lock or in your front door and be able to "Buzz" in your visitors. Suitable for use with security doors, building entrances or exits or external gates.

*Automatically open your gate from within the safety of your home.*

S 5385 Only **$47.20**

## 7 in 1 Learning Remote

*Replaces up to seven individual remote controls.*

- Simple to use and program.
- Memory is maintained even with the batteries removed
- Suitable for TVs , VCDs, LDs, VCRs, amplifiers, karaoke machines and one auxiliary
- Stylish ,rugged slimline design
- Powered by two AAA batteries.

**Ideal as a replacement for your worn out remotes. Save $$$ on the cost of repairing your old ones!**

A 1006 Only **$35**

## 12 Function Auto Ranging DMM

Autoranging multimeters are great if you don't have a free hand to change ranges on your DMM. Ideal for service persons or hobbyists

*Incredible 3 Year Warranty!*

**Features**

Manual override of auto-ranging
- Range hold & data hold
- Auto power off
- °C Temperature range
- AC < 400mV - 600V
- DC Volts < 400mV -600V
- Resistance < 400Ω - 40MΩ
- Continuity buzzer
- AC/DC current < 400μA - 10A
- Transistor tester
- Diode check
- Rubber holster included

**Includes K-Type Temperature Probe.**

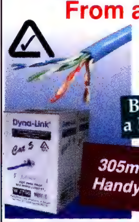
Q 1132

Only **$59.95**

## Approved Cat 5 Cable

**From as little as 36¢/m!**

when you purchase 2 boxes or more



W 2750 Cat 5 Cable

Buy a 305m box and save a Bundle, normally 90¢ /m

305m Handy

| | |
|---|---|
| 1 Box | $119 |
| 2 Boxes | $109 |

## Dual Trace CRO Card for PCs

*Turn your PC into a Fully functional Digital Storage Oscilloscope!*

**Features:** Multiple cards may be used in a single computer
- Wide bandwidth and high sensitivity
- Very low power consumption
- High sensitivity X-Y mode
- 20Msps per channel • Auto Setup
- Voltage Range: 50mV to 5V, 7 Steps • Time Range: 50ns/div to 0.5s/div, 1-2-5 22 Steps • 32 Kb Memory Depth • High frequency rejection filter in the triggering circuit
- Pre trigger

## PCB mount CCD Cameras

Using only a 3 wire connection, these mini cameras can be installed so they are virtually undetectable.

Three models to choose from.

Be Quick limited stocks at this price!!

S 9010
S 9011 with Audio
S 9021 Pinhole + Audio

All models were $119,

NOW A CRAZY **$69**

S 9021

All models require regulated supply. (M9449) $31.85

## Gas Soldering Iron

Features : •Equivalent to 50W of power
- Up to 1 hours use per fill of butane
- Compact, portable and easy to use

**This month's RED HOT SPECIAL**

**Buy a T 2595 and receive a can of butane gas and roll of solder absolutely FREE! Valued at $11.50.**

**All up, a total saving of over $18.00.**

**Limited stocks, 50 only at this CRAZY PRICE!**

Ideal for those one off small solder jobs away from the work bench. No need to run out a mains extension lead to fire up your normal soldering iron

T 2595 ,Was $36.50

NOW **$29.95**

## Economy LAN Cable Tester

**The quick and easy way to test field wiring. Simple operation will save you hours of frustrating fault finding.**

*Features:*
- Auto/Manual mode
- LED indicators for all connections including Ground
- Will test 10Base-T, 10Base-2 ,RJ45/11, 258A, TIA 568A/568B and Token Ring
- BNC to RJ45 Adaptor lead included
- RJ45 to RJ45 Adaptor lead included
- Includes Soft carry case

D 3007 Was $119 NOW ONLY **$99**

## Water proof Bullet Style CCD Cameras

***Ideal for use outdoors, in humid or water logged environments.***

*Features:*
- Internal regulation, requires standard 9V DC supply (M 9236 $13.50)
- Compact & durable housing (Size: 22Ø x 61mm)
- Includes swivel mounting bracket
- Waterproof to 5m
- 380 lines resolution (S 9085) B/W
- 330 lines resolution (S 9135) Colour

S 9085 Black and White , Only **$175**

S 9135 Colour , Only **$270**

## Power Supplies For Life

**These bench top power supplies are compact, stylish & functional. Ideal for experimenting, designing, testing & repairing a wide range of electronic appliances. Separate digital LCD meters are provided for voltage & current settings. All models feature current limiting, adjustable voltage & current settings.**

### 30V /5A Power Supply

*Features:*
- Fully regulated
- Up to 30V output @ 5A
- Current limited
- Short circuit and overload protected
- Floating outputs

M 8205 Was $345

NOW **$299**

### 18V /10A Power Supply

*Features:*
- Fully regulated
- Up to 18V output @ 10A
- Current limited
- Short circuit and over-load protected
- Floating outputs

M 8210 , Was $420

NOW **$335**

## Professional Soldering Station

*Features:* • Precise temperature control • LED Temperature Setting Display • Superior ceramic heating element • Zero-volt switching • Light weight ergonomic mini handle • Cleaning sponge tray incorporated in base • Temperature range 200 - 500°C • Temperature setting lock facility • Iron stand can be mounted either side • 4mm earthing point for anti-static strap

This month receive the T 2439 Solder Roll Holder at no extra charge when you purchase the T 2438. That's $13.60 extra value ABSOLUTELY FREE! Mention this advertisement and we will throw in a roll of T 1100 roll of solder . That's an additional $7.15 value at no extra cost.

T 2438 **$250**

*2 year Warranty!*

> ***"We have been using the T 2438 for 10 hours per day for the last 12 months. Our technicians are impressed with the quick heat up time, accuracy of the temperature display and ease of use."***
>
> *Richard Opie, Pentacom QLD*

## 2 Channel 6" B/W Monitor

Monitors up to two CCD cameras and switches between them automatically

- May be configured to automatically switch between two A/V inputs
- Manual override capability for monitoring a single input continuously.
- Variable switching interval
- Video and audio outputs are provided for a recording VCR
- DC output for powering CCD cameras with internal voltage regulation.

S 9090 Only **$135**

ordering: www.altronics.com.au • fax order line (08) 9328 3487

**1-800 999 007** **Perth (08) 9328 1599**

12 months minimum warranty*

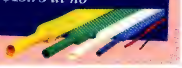
**ALTRONICS**

## Flameless Heatgun

**Reduces heatshrink quickly and effectively without burning it!**

*Features:* •Regulated flameless heat output •Powered by a refillable gas cartridge •Trigger-actuated piezo electric starter •Safety lock to prevent accidental ignition •Compact and stylish

*This month Buy the T 2480 and receive a BONUS W 0880 Hobby Heatshrink Pack Valued at $15.75 at no extra charge!*



T 2480 Only **$36.50**

## DMM with Lux, Temperature, Humidity & SPL

This amazingly versatile instrument features a light (lux) meter, a sound pressure level (SPL) meter, a temperature probe, a relative humidity (RH) range, as well as all the normal functions of a regular DMM.

*Features:* • Manual override of auto-ranging • Range hold & data hold • °C Temperature range
- •AC < 400mV - 600V
- •DC Volts < 400mV -600V
- • Resistance < 400Ω - 40MΩ
- • Continuity buzzer • AC/DC current < 400μA - 10A
- • Transistor tester • Diode check

Q 1140 Only **$109**

**Includes K-Type Temperature Probe & Rubber Holster.**

## Thunderous Subwoofers

**AMAZING TWO FOR ONE OFFER!**
**Buy one of these fabulous subwoofers and get another one of equivalent value FREE!**
**That's up to $155 worth of extra value.**

*Not only do these sound sensational, they look sexy too!!*

The polypropylene cones which are mirror finished will not flex or distort under high power use. They are specially designed for small sealed or vented enclosures.

| | |
|---|---|
| C 3048 120W 8" | $105 |
| C 3050 150W 10" | $115 |
| C 3052 200W 12" | $155 |

Ideal for use in a car for a punchy addition to your stereo system.

### Apology

Dear customer, in our May and June advertising we inadvertently advertised our Q 1150 capacitance/Inductance meter at 20% off. Regrettably, the discounted price shown was only around 10% off. This was a genuine error on our behalf and it was not our intention to mislead or deceive. As a gesture of goodwill we have decided to re-run this product at the wrongly advertised price of 20% off.
That's right you can get the meter for $87.20. If you purchased the the product in May or June and have not been notified of the error, please contact us with your proof of purchase for a refund of the difference.
Altronics apologises for any inconvenience.

Jack O'Donnell M.D.

## Infra-Red Wireless PS/2 Mouse

*Install this infra-red mouse and be un-hindered by computer cable tangles!*

*Features:* • Simple to install
- • 2 Scroll wheels (Up/Down & Left/ Right )
- • Compact easy to install receiver
- • Wide (160°) Operating angle
- • User selectable third button
- • Cable free
- • Microsoft Windows® 3.1/NT/ 95/98 compatible
- • Automatic battery save mode
- • Complete with software

NEW

D 2065 Only **$49.95**

## Mains Power *ANYWHERE ANYTIME!*

These inverters will generate 240V AC power from your car battery! Powers appliances such as televisions, VCR's, incandescent lights, shavers, power tools, etc.

*Features:* • ±10% regulation, modified square wave output • 90% Efficiency
- •Thermal and overload protection
- •Compact and lightweight
- •Audible Low Battery Alarm & Shutdown
- •High Surge Capability
- •Fan cooled

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|---|---|---|
| M 8110 140W Inverter | $152.95 | $99 |
| M 8115 300W Inverter | $250.95 | $149 |
| M 8118 600W Inverter | $408.45 | $249 |

**Hurry , limited stock 50 of each model only at these insane prices!**

## UpTek Inductance & Capacitance Meter

*An essential piece of test equipment for designing crossovers, power supplies, RF circuits, etc.*

*Features:*
- • 3.5 Digit LCD Readout
- • Diode & Continuity Test
- • Auto Power Off
- • Shock-proof rubber holster
- • 20μH-20H Inductance Range
- • 200pF-20,000μF Cap. Range
- • Continuity Buzzer
- • Diode Check
- • Individual zero adjust for capacitance & inductance range

**SAVE 20%!!**

Q 1150 WAS $109, NOW **$87.20**

## MINI DRILL KIT

**Great for drilling PCBs, polishing, or engraving.**

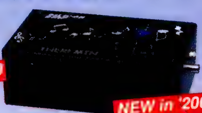
Includes two cutting disks, sand paper sleeve, engraving bit, four chucks and a PCB drill. A powerful high speed 12VDC motor will easily handle any task.

T 2303 Was $31.45...
NOW ONLY **$20**

## KITS

### THEREMIN INSTRUMENT KIT

(SC Aug. '2000) Create musical effects with hand gestures with this Theremin kit.
See website for full details.



NEW in '2000

K 1135 **$44.50**

### DIGITAL TACHO KIT

NEW in '2000

(SC April. '2000) Indicate engine RPM with this 4 Digit Tachometer. See website for full details.

K 4342 **$64.95**

### CD COMPRESSOR KIT

(SC June. '2000) Compress the Dynamic range of a CD. Suitable for Car or Hi-Fi use.
See website for full details.

NEW in '2000

K 5580 **$74.95**

### POWER SUPPLY KIT

NEW in '2000

(SC July. '2000) Suitable for use as a bench top/ Laboratory power supply. Supplied in a rugged steel case. See website for full details.

K 3250 **$149.95**

### LOUDSPEAKER PROTECTION KIT

(SC Aug. '2000) Protect your valuable speakers from overload with this easy to build protection kit.
See website for full details

NEW in '2000

K 5055 **$39.95**

## 20MHz Dual Trace 4 Beam Oscilloscope

**Allows Simultaneous display of original and magnified waveforms!**

With the increasing complexity of electronic circuits a high quality oscilloscope is an absolute necessity for service techs & serious enthusiasts alike.

*Features:* Wide bandwidth and high sensitivity • Very low power consumption • High sensitivity X-Y mode • Z axis (intensity modulation) • Simultaneous display of original and magnified waveforms on each input • Front panel electrical trace rotator • Regulated power supply circuit for accuracy • TV video sync • High frequency rejection filter in the triggering circuit

FREE CRO & PROBE OFFER
Purchase the Q 0150 this month for $749 and receive a Q 0174 CRO probe valued at $41.50 at no extra cost.

Q 0150 ONLY **$749**

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****12 months minimum warranty:** 12 months from date of supply. Goods becoming faulty in this period should be returned to our premises with evidence of purchase and $6 money order, cheque or stamps to cover return postage.

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***Overnight Jetservice:** Up to 3kg is $11, 3kg to 5kg is $18.00—We will process your order the day received (if placed before 2.00PM WST) and despatched for delivery the next day. Country areas please allow an additional 24-48 hours. Not available to PO boxes.

**Heavy Service:** All orders of 10kgs or more must travel Express Road—Please allow up to 7 days for delivery. $13.20 to 10kgs. $16.50 over 10kgs.

**Insurance:** As with virtually every other Australian supplier, we send goods at consignee's risk. Should you require insurance cover against loss or damage please add $1.00 per $100 of order value (minimum charge $1). When phone ordering please request "Insurance".

**Altronics Resellers:** Chances are there is an Altronics Reseller right near you—check our catalogue or phone us for details of your nearest dealer. An up to date reseller listing is available at our internet site at www.altronics.com.au 24 hours a day.

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# HISTORY & CROSSWORD

Published since 1922, **Electronics Australia** is one of the longest-running technical magazines in the world. Here are some interesting items from past issues:

## 50 YEARS AGO

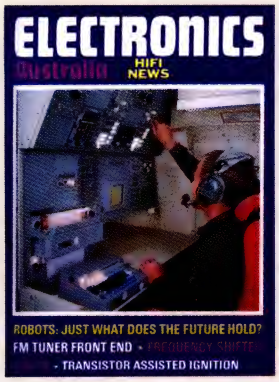
**Our Broadcasting:** Australia must surely stand high in the world in the coverage of its broadcasting services.

We note that the latest figures released on broadcasting licences has now passed the total of two million. If we add to this figure an unknown number of sets which are not licensed, and we regret to say that if we are realistic we must do so, we would have a large figure against a total population of about eight million, most of whom of course, can never be individual owners.

**Neutron detection:** The presence of particles called 'neutrons', which are emitted by some radioactive materials and could endanger health of atomic laboratory workers, can now be detected by a new device.

The instrument, shaped like a policeman's nightstick, is called the 'neutron counter tube.'

The counter tube will be useful in monitoring an area near atomic piles or atom smashers before laboratory workers are admitted to the area. The counter tube will show whether neutrons have penetrated the shields installed for protection against radiation exposure.


ELECTRONICS
Australia
HIFI NEWS
ROBOTS: JUST WHAT DOES THE FUTURE HOLD?
FM TUNER FRONT END • FREQUENCY SHIFTER
• TRANSISTOR ASSISTED IGNITION

## 25 YEARS AGO

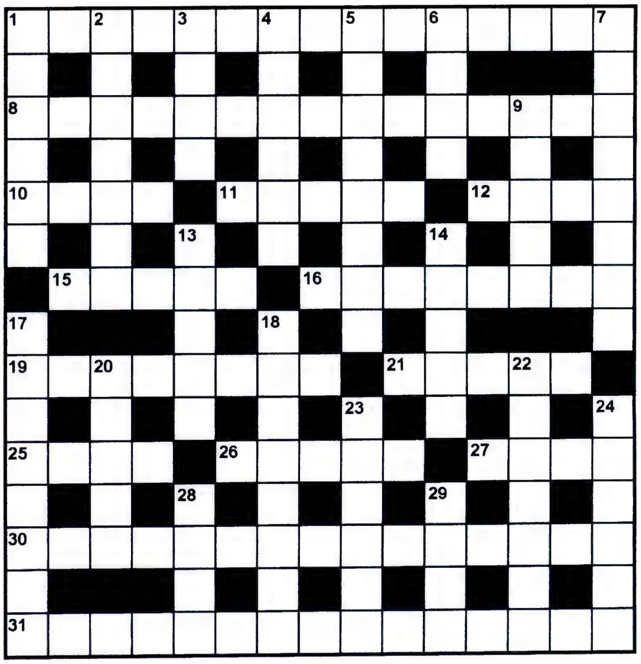
**Computer responds to voice commands:** Dr Martin Ackroyd, head of the Cognitive Systems Section at EMI, England, talks to a desk-sized computer that is programmed to understand spoken words and convert them into digital signals. This revolutionary computer, developed jointly in America and England, is already available for commercial use.

So far, it is capable of understanding and acting on a vocabulary of up to 750 words or short phrases (in any language or dialect), and further research is underway to improve this.

The system is immune to background noise in factory or workshop locations, and is thought to have potential in scientific, commercial and industrial applications.

**Dick Smith announces a record turnover:** The past year has seen the turnover of Dick Smith Electronics more than doubled, with turnover well in excess of $2 million.

According to Dick Smith, Managing Director, the major contributing factor to the increased sales growth has been the opening of two new stores in Sydney. These are located at Bankstown and in the City, and were opened in June, 1974 and April, 1975 respectively. **ea**



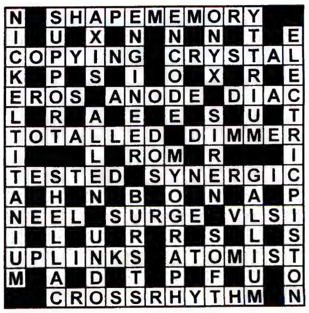
## ACROSS

1 Modern communication item. (6,9)
8 This disconnects joints. (11,4)
10 Average. (4)
11 First American to orbit the earth. (5)
12 Proponent of atomic structure. (4)
15 Standard code used in computers (init). (5)
16 First word of EDT, the piezoelectric crystal. (8)
19 Concerned with metal transformation. (8)
21 Find the solution. (5)
25 Non-SI unit of heat energy. (4)
26 Swift brute in the Internet! (5)
27 Activate a switch. (4)
30 Determining the functional derivative. (15)
31 Accessible communication item. (6, 9)

## DOWN

1 Data transmitting devices. (6)
2 Main conductors. (3,4)
3 Rhythmic characteristic. (4)
4 Control on an audio system. (6)
5 First to publish the calculus. (8)
6 Seek person by announcement. (4)
7 Photographic darkroom equipment. (8)
9 Variety of oxygen. (5)
13 Device to measure interval. (5)
14 Synthetic thermoplastic polymeric amide. (5)
17 Made additional record or copy. (6,2)
18 Emitter of electrons and/or light. (8)
20 Metallic strips used for radar interference. (5)
22 Loss of orientation. (7)
23 Australian organisation for TV distribution. (6)
24 Most distant point in orbit. (6)
28 Prefix often qualifying conductor. (4)
29 Distort. (4)

## JULY SOLUTION



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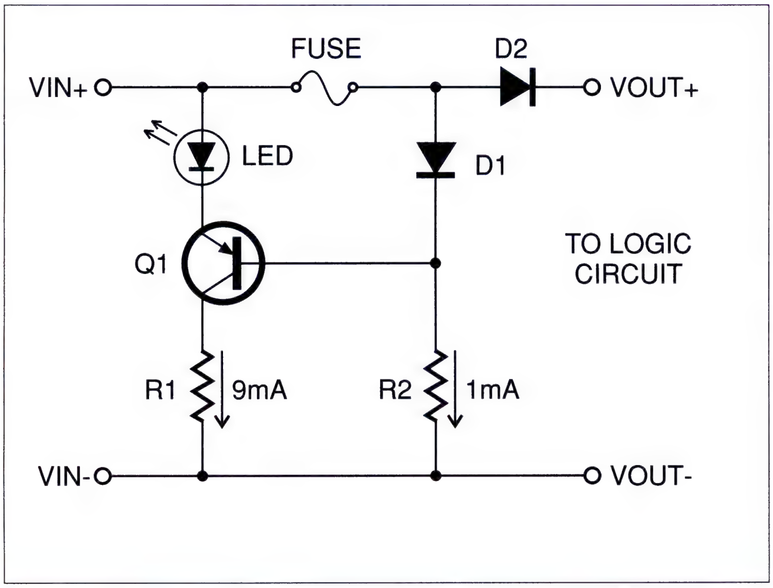
# generator

# CIRCUIT & DESIGN

**IDEAS FOR EXPERIMENTERS**



## Better, smarter blown-fuse indicator

**HERE'S AN IMPROVEMENT** to the 'Smarter blown-fuse indicator' described in the May 2000 issue of EA.

The disadvantage with this circuit is, as stated by the author, "...the standing voltage drop across D1 must be less than is needed to bias Q1 on..." This would make the circuit operation critical in some circumstances, however there is a simple solution - move the LED to Q1's emitter.

With this arrangement the base of Q1 must now be about 2.4 volts lower than Vin to turn Q1 on, so the voltage drop across diode D1 is no longer an issue.

The resistor values for the circuit as shown can be calculated as follows:

R1 (in kilohms) = (Vin - 1.9)/9

R2 (in kilohms) = (Vin - 2.4)/1

Round these values up or down to the nearest preferred value.

*Len Cox*
*Forest Hill, Vic.* **$35**

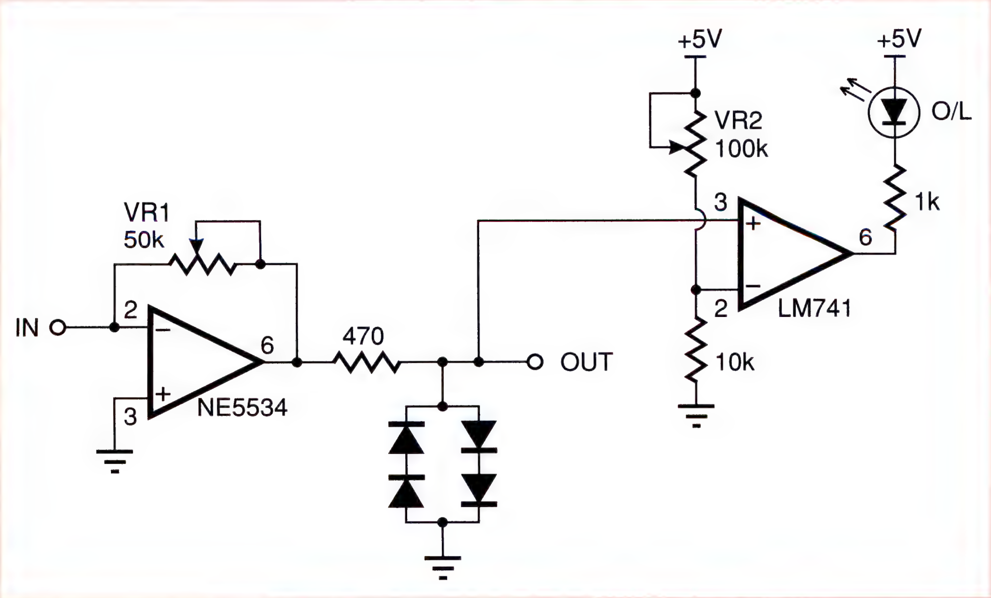
THIS MONTH'S WINNER!

## Soundcard input protector

**THIS SIMPLE CIRCUIT** is one I designed after damaging my sound card, and it is really just a limiter with a clipping indicator.

Here, the input preamp gain is set by VR1, and the clipping indicator level is set by VR2. The circuit is quite simple in operation; when the output of the opamp is above 1.2V p-p then the output signal is simply shunted to ground via the back-to-back diode strings. The 470 ohm resistor provides output isolation and limits the peak current flowing from the 5534's output.

I used 1N914's for the four clipping diodes as they provide around 0.6V of drop, since after some experimentation it was found that my soundcard started clipping at 1.2V p-p. This seemed slightly more than some other cards that I tried, which seemed to clip at about 1V p-p - in this case germanium diodes could possibly be used.



The second part of the circuit is a simple comparator stage which compares the output with a reference voltage set by VR2. When the preamp's output reaches 1.2V p-p, the opamp actives the overload LED (O/L) via a 1k limiting resistor. The unit is set up by adjusting VR2 so that the LED just lights up as the diodes begin to limit the output voltage - in this case at 1.2V p-p.

*Tom Pike*
*(via email)* **$30**

# IDEAS

Interesting original circuit ideas and design tips from readers. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide any further information.

## Win our 'IDEA OF THE MONTH' Prize! Valued at $469!

**As an added incentive for readers to contribute interesting ideas to this column, the idea we judge most interesting each month now wins its contributor an exciting prize, in addition to the usual fee. The prize is a Video Inspection Capture System from Allthings Sales & Services, which consists of a colour CCD camera, close-up lens set, adjustable stand and lamp, PCI video capture card and software, plus video cable and two plugpacks. You can find out more about this great system at the Allthings website; www.allthings.com.au.**

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## Professional finish for aluminium panels

**IN THE JULY EDITION**, Roger Johnson (Vintage Radio, page 92) suggested that a plywood or aluminium front panel be painted for a better appearance.

Many years ago I devised a near-professional finish for aluminium panels.

Bathing the panel in a strong solution of caustic soda etches the aluminium, leaving a bright, smooth, gray finish which even 30 years later looks neat and professional. Conversely, painted surfaces have long since gained a layer of grime and lost any pretence at professionalism.

The panels need to be perfectly clean and grease-free, and preferably scratch free. If the panel has been scratched during production, it should be rubbed down with steel wool to give it an even, gray appearance. In fact, I preferred this finish to a polished one as it gives a more grainy look to the finished product.

WARNING: WEAR RUBBER GLOVES WHEN USING THIS PROCESS.

Prepare a solution of 25 grammes of caustic soda in 250ml of water and submerge the panel. It should begin to bubble and zizz about within a minute or two. After about five minutes, use plastic tweezers to lift the panel from the solution. Rinse under the tap and judge the effect. You may prefer the results after 10 or 15 minutes. You might also like to experiment with a scrap of metal before you commit your finished panel, or to experiment with stronger or weaker solutions.

I can't emphasise too greatly the dangers of using caustic soda. I believe it's worse than battery acid in some respects. It can certainly eat into your hands, leaving very nasty ulcers that seem to take forever to heal. After use, dilute the solution with 10 or more litres of water and dispose of down the drain.

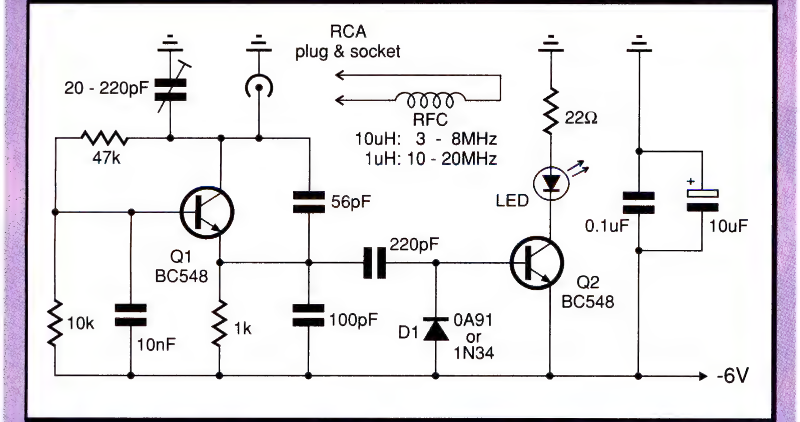
If you don't have or can't get caustic soda, you might be able to make-do with a drain cleaner such as 'Draino' or the like. These products contain a high proportion of caustic soda and should do the job on aluminium panels almost as well as the native product.

*Jim Lawler.*
*Hobart, Tas.* **$25**

### Oops...

The 'Dip Led' circuit presented here in the June issue (page 69) had a couple of drafting errors. Because the circuit uses a *negative* 6V supply rail, the polarity of both the OA91 diode and the 10uF electrolytic capacitor should be reversed.

The revised schematic is shown here. Also note that the reference to 'absolute wavemeter' in the text should in fact read 'absorbtion wavemeter'. Our thanks to the author for pointing this out. **ea**



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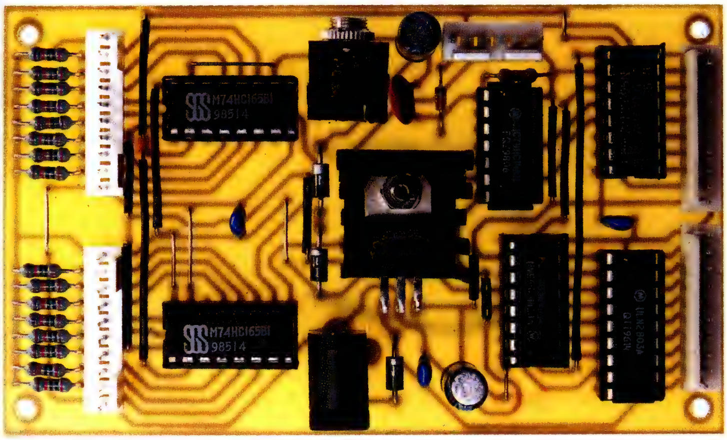


Fig. 1

socket, as it is the only PCB mounting socket easily available.

The other connectors on the PCB are 10 pin single row header pins and the 6-pin Gameboy connector. This last item is the tricky part – you can solder a cable (with the correct Nintendo plug) directly onto the pads, or use another 6-pin header. The connector for the Gameboy serial port can be ordered from us (please note that there are two sizes depending on the model of your Gameboy - more details on our web-page), or you can cut the connector off a Gameboy Link cable (available from most major department stores).

Now is the time to check over your work, making sure there are no solder bridges or forgotten IC pins, and power up the interface – but don't connect the interface to your Gameboy just yet. The power up should be fairly uneventful with the shift registers powering up in unknown states. As long as nothing smokes or gets hot at this point, all is probably well.

By the way, the interface can be powered from the Gameboy as well (through the serial port), just be careful how much current you draw. So, strictly speaking a plugpack is not really required unless you use the high current outputs, but more on this below.

## How it works

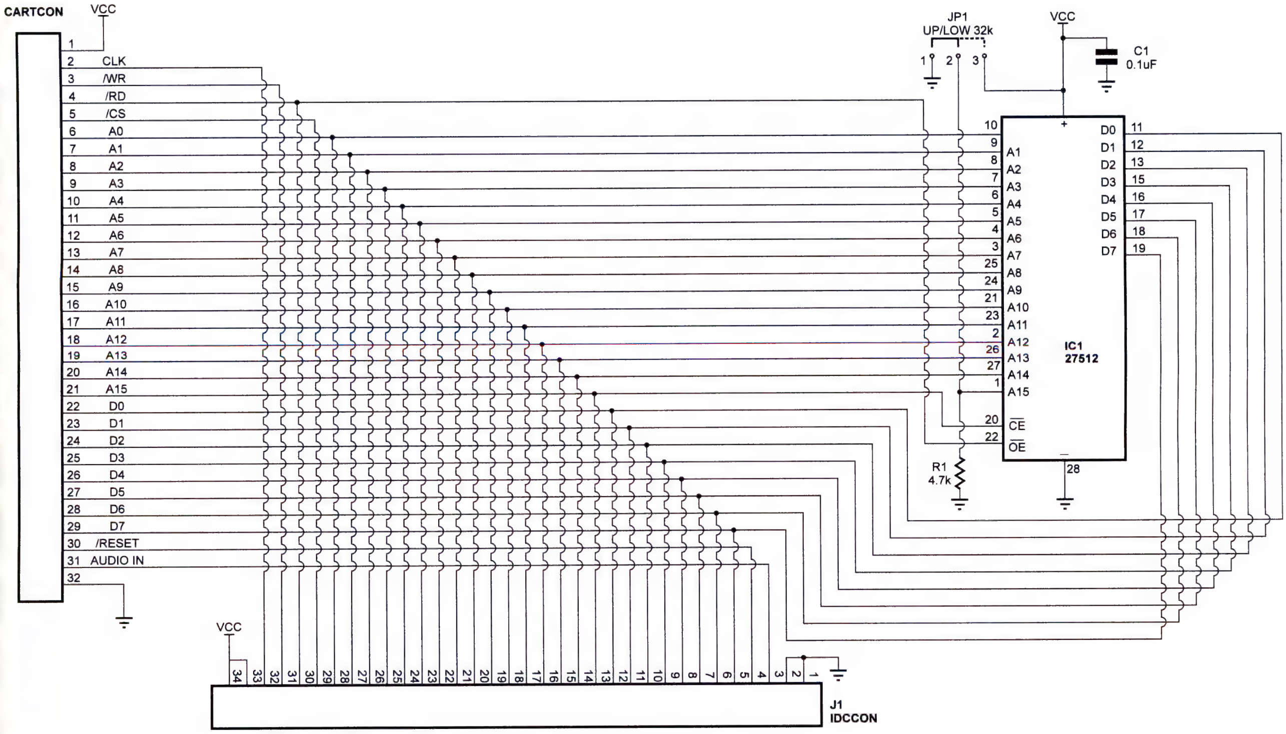
Time to explain how the interface works. The Gameboy's serial port is very rudimentary. All it consists of is one 8-bit serial shift register and a clock. When a serial transfer is started, the shift register clocks the data out of the 'Data Out' pin with most significant bit (MSB) first. At the same time data is clocked into the shift register from the 'Data In' pin MSB first. The clock automatically toggles down and up eight times until a complete byte is sent (or received). The clock's idle state is high.

The basic operation of the sixteen input, sixteen output interface is therefore to receive and send two bytes into the Gameboy's serial port. The interface achieves this using two parallel input serial output shift registers, IC3 and IC4 (two 74HC165 ICs). The output is done similarly using two serial input parallel output shift registers, IC1 and IC2 (two 74HC595s).

The only slightly tricky part is generating the 'load' clock for IC1 and IC2 (pin 12), IC3 and IC4 (pin 1). A load clock must be generated so that the data, in case of IC1 and IC2, is transferred from the internal shift register to the parallel output pins (pins 15 and 1 to 7). For IC3 and IC4 the load clock transfers data at the parallel input pins (pins 11 to 14 and pins 3 to 6) into the shift register inside the ICs.

The load clock is derived from the serial shift clock, pin 5 on the Gameboy connector. The timing diagram in Fig.4 shows how the clocking works. When not in use,

Fig. 2



this clock normally sits high. When a data transfer takes place this clock goes low-high-low-high and so on (16 times – two bytes worth at 8.192kHz).

When this clock goes low C6 is discharged through diode D4. When the serial shift clock goes high C6 begins to charge through R1 – but it charges quite slowly and is discharged again by the next clock cycle. While the clock toggles, the input to the Schmitt trigger inverter (IC5a) remains low enough for the output at pin 2 of IC5 to remain high.

At the end of 16 clock cycles C6 charges fully and pin 2 of IC5 goes low, thus activating the parallel load of IC3 and IC4 and therefore 'reading' the inputs until the next clocking cycle starts (i.e. when the Gameboy reads the data).

The load clock for IC1 and IC2 is just an inversion of the load clock for IC3 and IC4. The inversion is achieved through the inverter IC5b. This load clock goes low at the beginning of the shifting cycle and high at the end. This low to high transition sends the newly arrived serial data to the parallel outputs of IC1 and IC2.

Resistors R2 to R17 are pull-up resistors at the inputs to IC3 and IC4 and when left unconnected the inputs will simply read high. To make these inputs go low, all that is required is a 'short circuit' to ground. The upper 8 bits of the output shift registers, IC2, are connected to IC7, a ULN2803 Darlington transistor array. This makes these outputs capable of driving 500mA each. The voltage source connected to these outputs via pin 10 of IC7 is Vdd, the voltage input from the plugpack (connector P1) via a diode. So if no voltage source is connected to P1, these outputs will not function. If you need extra logic outputs, simply bridge across the inputs and outputs of IC7.

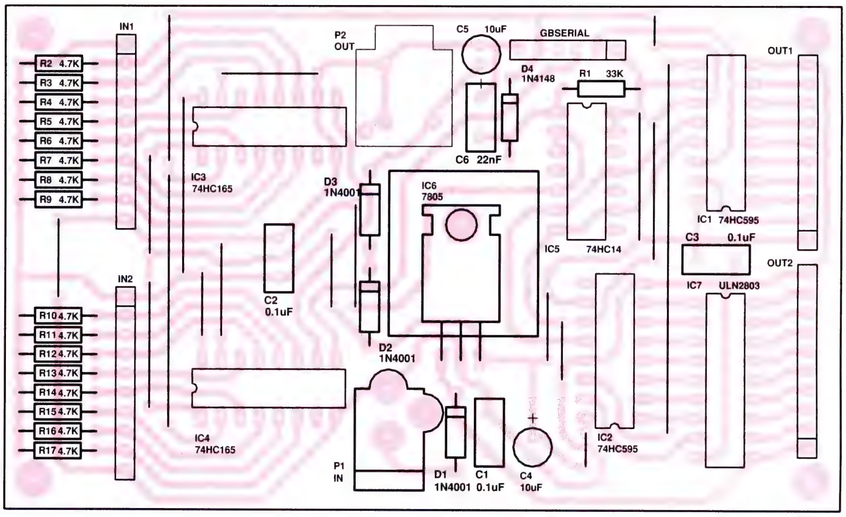
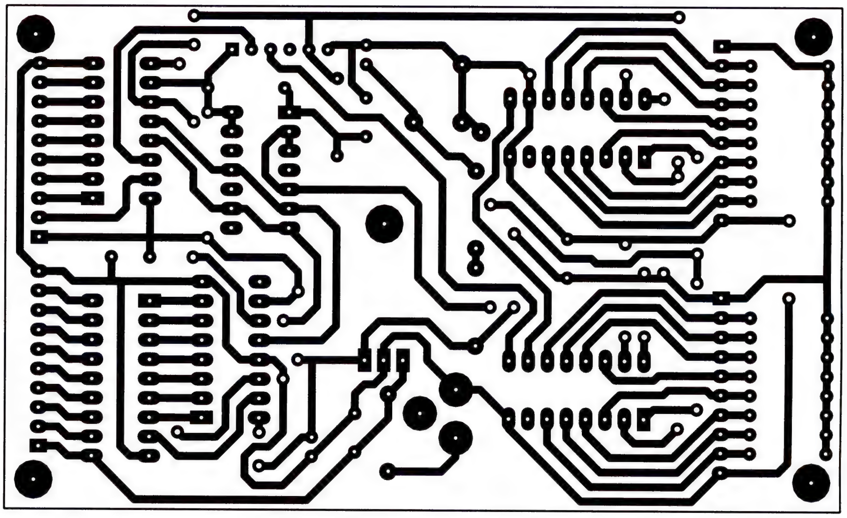


Fig.3



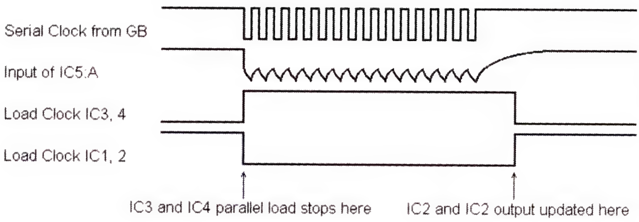


Fig. 4

*Above: The timing diagram for the serial interface's load clock, as derived by IC5a from the Gameboy's serial shift clock (pin 5 on the GB connector).*

The remainder of the circuit is the power supply and regulator. Diode D1 is a protection diode, C1 to C5 power supply filtering capacitors, and IC6 is a 5V regulator. D2 and D3 are used to drop the 5V to about 3.6V to run a 3V Gameboy from connector P2. As already mentioned, if you have a 6V Gameboy you can simply insert wire links instead of D2 and D3 to run it off 5V.

## Experimenter's Cartridge

To drive the interface described above you need to run software on the Gameboy. To do this we suggested that the easiest way is to purchase a GBXChanger and a reprogrammable cartridge.

However, if you are keen to produce your own cartridges for the purposes of experimenting, we have included a double sided PCB pattern you can use. The pattern includes the layout for the cartridge connector and provides space to solder a 34-pin IDC connector so that you can use ribbon cable to plug your Gameboy onto a breadboard. There is also space for a 64KB EPROM that allows you to store two sets of programs (one in the lower 32kB and one in the upper 32kB), selectable with a jumper.

The component overlay and schematic are also shown. The PCB layout is fairly straightforward (although parts of it are quite tight) and you could easily replace the top layer by a number of wire links which makes the boards single sided. The Protel PCB files can be downloaded from our website if you want to modify them. The required thickness for a cartridge PCB is about 2mm. We achieved this by putting the PCB into an existing game cartridge (hence the big holes in the middle of the PCB).

Fig.2 shows the schematic of the experimenter's

## Find that break!

*I was asked to repair an aging National Panasonic VCR, Model NV-300 and its wired remote control. While the VCR proper required some component replacements to revive it, the remote cable's shield was open circuit. However, before deciding if a replacement cable was required, I wanted to know where the break was located.*

*My previous approaches to approximate the location of a break in cable tended to leave the insulation damaged (of little consequence when its your own children's games controller). In this instance I was looking for a more scientific, less destructive method.*

*As this type of single-core cable is often specified by its capacitance per metre and having recently purchased a new capacitance meter, I decided to measure the capacitance at each end and then, assuming the cable's capacitance was reasonably linear in its distribution, use the readings to determine where the break was located.*

*The cable measured five metres and the capacitance readings were 773pF and 20pF at the 2.5mm plug and hand control ends respectively. These readings were electrical representations proportioned between the two pieces of cable separated by the break.*

*Thus a simple calculation provided the length of 126mm by taking 5000mm multiplied by 20 and divided by (773 + 20).*

*As time had run out on this repair I decided to double the answer to account for tolerances and cut at about the 250mm point, resulting in a still acceptable length for the wired remote and an inexpensive repair for the client.*

*A little luck and the scientific approach had won again...*

Has anyone else tried using capacitance to locate a broken conductor? I have had no cables to test since I got my capacitance meter so I don't know if I would have solved the problem as Bill did.

I've heard of a number of ways to find a break but most use fairly sophisticated equipment. One system uses an RF signal and times the echo returning from the break. That's a bit too professional for the average workshop. Then someone has used a high frequency audio signal and something like a telephone coil to determine its presence along the suspect cable. I tried this but it didn't work.

So Bill's application of a good capacitance meter sounds like the long-sought solution to a fairly common problem. Thanks for that, Bill.

And the 100 yards of cabtyre? It had been dumped because the active lead was broken. On the assumption that a 100 yard extension lead was a bit much, I cut the cable in the middle. This left me with a 50 yard extension cord and 50yds of cable of doubtful value.

Another cut in the middle of the doubtful bit gave me a good 25 yard extension cord and 25 yards of cabtyre with a broken conductor.

With nothing to lose, I made another cut at 12.5 yards, then another at about six yards.

Since I now had four extension cords ranging in length from six to 50 yards, I had no need for the last 6 yards so I began to cut it into three-inch sections – I was determined to find that broken conductor.

And do you know where it was? Nine inches in from the original start of the cable. If I had had a capacitance meter, and Bill Fitzsimons' ingenuity, I might have ended with a 99.9 yards long extension lead!

Now we come to a contribution from Robert Hitchin, of Burpengrry in Queensland. Robert writes about a subject that a good many of us are unfamiliar with – security alarms.

I know that there have been numerous articles in the magazine about alarm systems, but I think most of the projects have been for car alarms. Domestic and shop alarms seem to run a poor second to the need to protect the Kingswood. Robert's story is probably typical of repairs to systems installed cheaply by unqualified or inexperienced workers. Here's what he has to say...

## Insecure security

*Security alarms are a branch of electronics that seem to get lost amid the computers, VCRs and TVs of day to day life yet they can be as complex as any other type of modern device. Most people tend to see them as very simple devices but nothing could be further from the truth.*

*One major difference is that an alarm consists of a number of components spread throughout a building, with each item dependent on the others for support.*

*I am retired now and only do an occasional job just to keep my hand in. Recently a person who had taken over a business asked me to check and see why their alarm did not make any sound.*

*It was a simple local alarm with three passive infra red (PIR) motion detectors and a magnetic reed switch on the front door. The alarm panel was just inside the door covered by the first PIR with an unenclosed siren mounted above.*

*All the cabling was exposed and simply glued into corners. The power supply was an AC plug pack and no back up battery was fitted.*

*On inspection it was obvious why there was no noise. Someone had cut the wire between the siren and the panel! Not only did they cut it; they removed about a metre of wire and simply left the ends hanging.*

*Further inspection showed that the siren had no backup battery and there were only two sectors active. The third (delay) sector had been shorted out by something...*

*A quote was given and the job started early one morning. I expected it to take about four or five hours. This proved to be very optimistic.*

*The first thing I discovered was that the reed switch on the front door was apparently dead. In fact the reed itself was fine but the cable had been run under the edge of the carpet and was jammed under some shop fittings. It was shorted out and there was no sign of an end of line resistor.*

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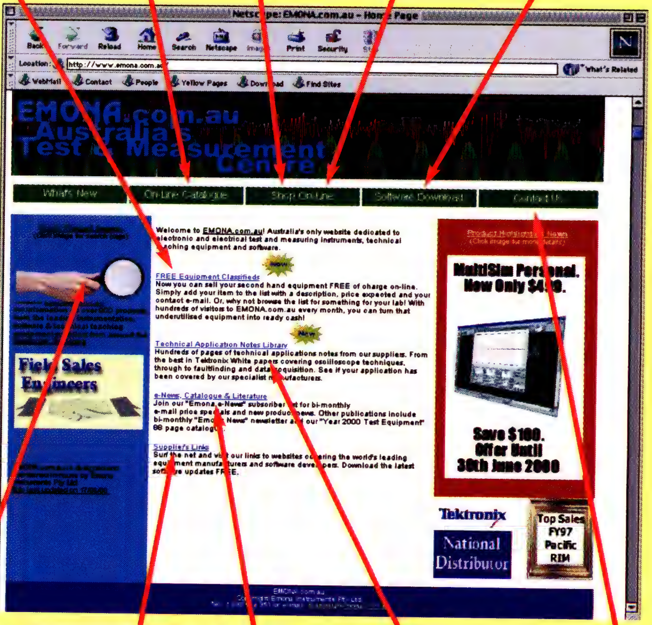
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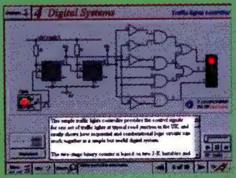

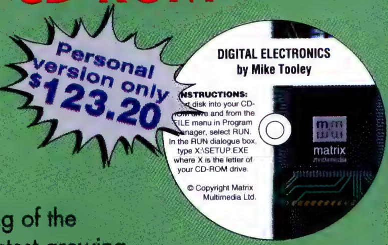
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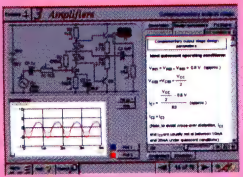

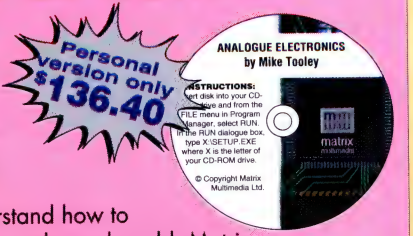
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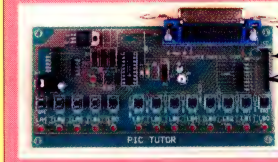

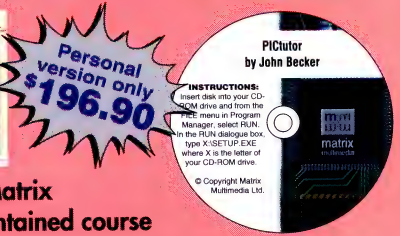
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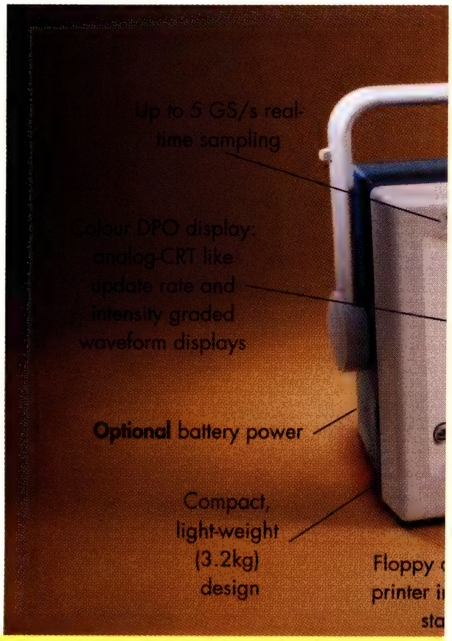
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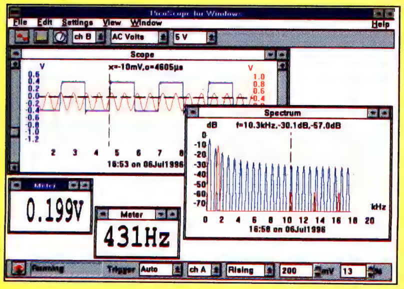

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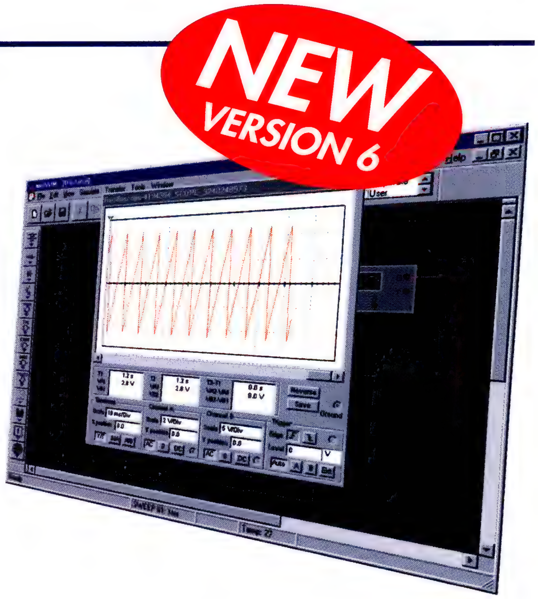

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*We decided to leave this and to operate on the PIRs only, as the owner was not keen on moving his stock to allow the cable to be replaced.*

*The end of the shorted cable that entered the panel was connected in series with the first PIR relay and a resistor fitted between the return wire and the sector terminal. It would work, but it does make you wonder.*

*The remaining two PIRs were on the same circuit, but the end of line resistor could not be found – although it could be measured at the panel. Following the cable through eventually provided a lump of electrical tape which proved to have the missing resistor inside!*

*This led to more problems when we discovered that the panel alarmed when PIR2 was triggered, but did not alarm when PIR3 was triggered unless PIR2 was triggered first. As this situation could not arise, it meant that PIR3 was useless.*

*The end result was that PIR3 had either normally open or normally closed contacts. The contacts had been connected in parallel with PIR2, which had its resistor on the panel side of the connection. This meant that if PIR3 triggered before PIR2, then because PIR2 was closed nothing happened. If PIR2 triggered, the sector was in alarm and PIR3 made no difference. Putting the normally closed contacts of PIR3 in series with PIR2 solved the problem.*

*A new back up battery and siren cover raised the standard a little, as did the conduit enclosing all cables within easy reach. I wouldn't claim that this was a good system even when I had finished. But it did work the way it was supposed to.*

*Before I left, I spent time explaining the failings to the client and pointing out what should be done. But I fear it fell on deaf ears.*

*I hope this example is of some interest to you as it shows the poor understanding and workmanship found in this field of electronics. I had quoted for five hours and got paid for that. The other two and a half hours I've added to my experience bank. Shame it can't be spent.*

Thanks for that story Robert. It goes to show how a relatively simple job can become a nightmare because of factors that were hidden at the time of the first survey. I recall an antenna installation in a country house where an apparently ordinary brick wall turned out to be thirty inches of solid sandstone! I had to buy a special three foot long masonry drill before I could finish the job.

My own knowledge of alarm systems is very limited but I think I would have made a better installation than that which Robert found. I imagine that his job was originally done by the shopkeeper or the owner. Not even an electrician would leave cables uncovered and unsecured.

## Y2K bug still biting

Now for a very brief story from Graham Jones, of Launceston in Tasmania. Graham writes...

*I thought the Y2K bug had missed most of us, but it finally caught up with me after the 29th of February.*

***It may be able** to measure your blood glucose level to two decimal places, but it doesn't know what day it is...*

*An Akai VCR model VS53 was showing one day out after the 29th.*

*I checked the setup arrangements and found that the date was set in firmware in the machine. It was impossible to set the date to 29/2/2000 so now it will always be one day out.*

Well, Graham. I think most of us have been caught by that particular bug in something or other last Feb. My experience was with a blood glucose meter that remembered it was the year 2000, but didn't know about leap years and things.

It seems that some designers just changed the year, without checking further. The century leap year only comes round once in four centuries so it would be easy to overlook.

There is one solution to the problem though. If you set the calendar to 2017, the day and date comes good. It seems that the 2017 calendar is exactly the same as the 2000 calendar and can be used wherever the year is not displayed.

And that, I'm afraid, is yer lot for the month! (Heard that before?)

I'm in the process of preparing a new Index of Serviceman articles, covering the period from April '96 to the present time. This might be ready by next month, so watch for it! **ea**

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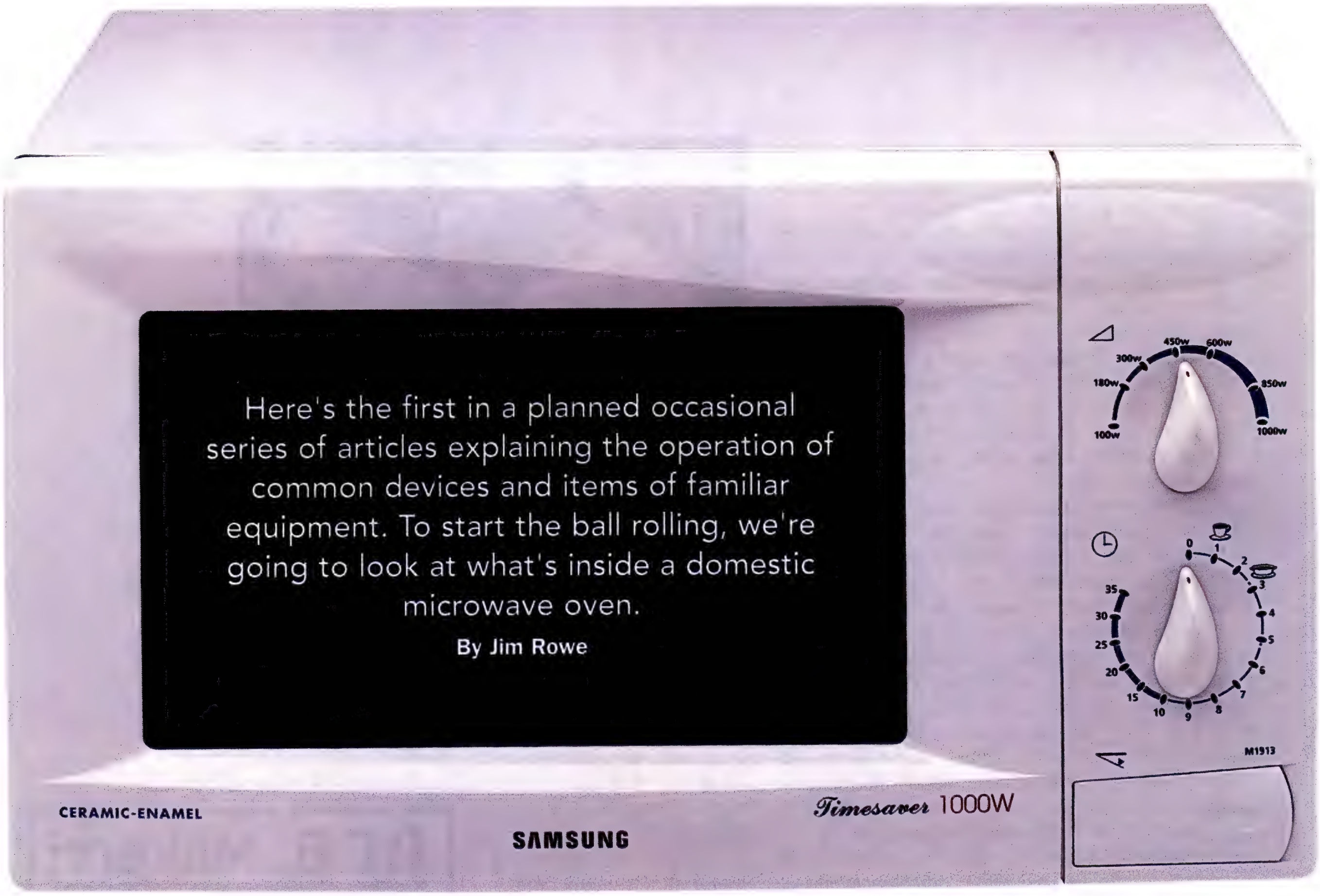


Here's the first in a planned occasional series of articles explaining the operation of common devices and items of familiar equipment. To start the ball rolling, we're going to look at what's inside a domestic microwave oven.

**By Jim Rowe**

# The Microwave Oven

**FIRST DEVELOPED** in about 1962, microwave ovens are basically just a power supply and a magnetron valve which turn electrical power from the mains into microwave radio energy – plus a metal enclosure into which the radio energy is beamed, to heat the food placed inside. If you like, it's a radio transmitter with its output waves all directed inside a tin box, to heat up your cup of coffee or cook your chook, leg of lamb or whatever.

In all except the cheapest models there's also a microcomputer-based controller, used to pulse the magnetron on and off to control its effective power level, and also control the overall cooking time. Cheap models have just a mechanical or simple electronic timer.

But why do these 'radio ovens' work at microwave frequencies? Basically because the higher the frequency of the radio waves, the faster the food heats up – and speed is an important feature, in the modern world. Concentrated radio waves heat food because the strong alternating electromagnetic field distorts electrically charged food molecules first one way, and then in the reverse direction. This alternate tugging in opposite directions generates frictional heat, and the faster the field reversals take place, the more heat is generated.

The only qualification to this is that if the frequency is increased too far, the radio waves can't penetrate very far into the food, and heating tends to be concentrated in the outer layer.

In fact the optimum frequency turns out to be around 2450MHz (2.45GHz), in the microwave spectrum. This happens to be just the right frequency for optimum heating of the water molecule ($H_2O$) – and water is of course a major component of most food. So nowadays most microwave ovens operate at this frequency.

Note that microwave energy tends to cause heat to be generated inside the actual food itself. It's this that makes a microwave oven so efficient; it doesn't waste a lot of energy heating up the oven, dishes and whatever. Most of the energy is directed right into the food.

Modern microwave ovens still use a magnetron valve to generate the required amount of 2.45GHz radio energy, just like the first models of 1962. That's because a magnetron is still the simplest and most reliable way to generate the required 400 to 900 watts of continuous microwave energy.

Yes, that power level is equivalent to the output from quite a husky microwave transmitter or radar set. And magnetron valves were developed in the 1940s, specifically for this kind of job.

So in a sense, a modern microwave oven effectively combines a radar transmitter and a computer, both with the sole job of heating up your tucker!

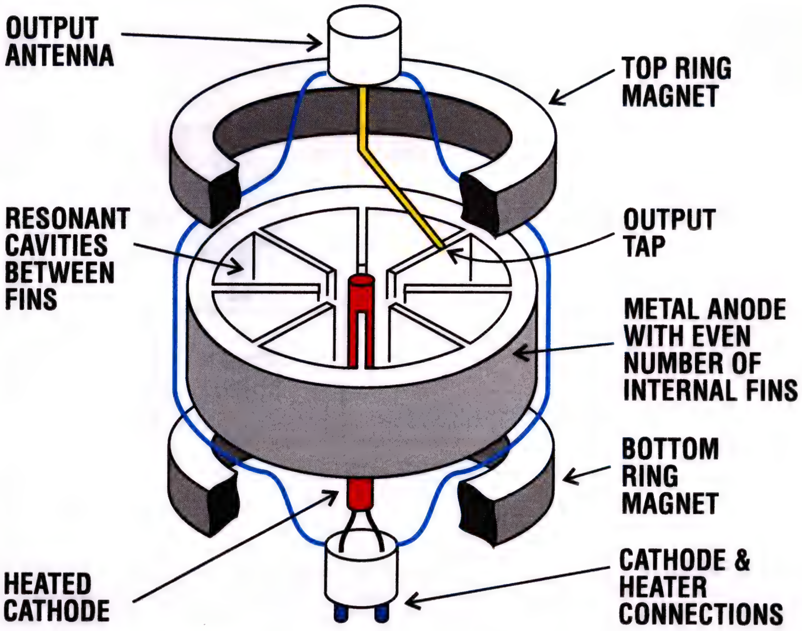

OUTPUT ANTENNA
TOP RING MAGNET
RESONANT CAVITIES BETWEEN FINS
OUTPUT TAP
METAL ANODE WITH EVEN NUMBER OF INTERNAL FINS
BOTTOM RING MAGNET
HEATED CATHODE
CATHODE & HEATER CONNECTIONS

**Fig.1:** *The basic structure of a magnetron tube — a very efficient generator of microwave energy.*

## The magnetron

But back to the magnetron. How does it work? Essentially it's a fancy kind of diode valve – the simplest valve of all. Just a heated cathode, boiling off electrons in a vacuum, and with a cylindrical metal anode placed around it, with a positive voltage on it to attract the electrons...

Well, not quite. In a magnetron the anode is in the form of a cylinder with internal fins, as shown in Fig.1. And the fins are carefully arranged so that the little cavities between them are electrically *resonant* at the magnetron's operating frequency – in this case, 2.45GHz. In other words, the inductance of the fins and the capacitance between the walls of the cavities can interact, just as in a normal tuned circuit, producing a natural tendency to oscillate at this frequency.

As well as that, ring-shaped *permanent magnets* are placed at top and bottom of the magnetron, so that there's a strong magnetic field passing through the valve axially, in a direction parallel to the cathode. It's this magnetic field that gives the valve its name, of course.

Now the anode and its fins are typically about 4000V positive with respect to the cathode, so electrons leaving the cathode tend to be accelerated towards one of the fins by the strong electric field. However once they're moving, they become influenced by the axial magnetic field, which tends to deflect them around in a circular path.

The nett result of this interaction is that the electrons tend to be swung back towards the cathode. However in swinging around, their electrical charges distort the electric field in the gaps *between* the fins, and this in turn tends to excite the fields inside the cavities – so they begin oscillating, at their resonant frequency. And in giving some of their energy to the electric field, to excite this oscillation, the electrons are slowed down. This reduces the influence on them of the magnetic field, so they tend to move outwards again towards the fins.

If the ratio of the two fields is carefully adjusted, what happens is that the electrons do gradually move outwards and eventually reach one of the fins, but they do so in *cycloidal* paths, in the process donating most of their energy to the oscillations in the cavities. As a result, the inner ends of the fins tend to develop a strong AC voltage at 2.45GHz, superimposed on the DC voltage. When one fin is more positive, the next fin is more negative and so on.

This in turn causes the electrons to 'bunch together', in a relatively small number of radial streams or 'curtains' of *space charge*, which rotate around inside the valve – rather like the poles of a rotary switch, or commutator. And the curtains rotate at a speed synchronised with the oscillations of the cavities, so that they move from one fin to the next in one half of a cycle at the magnetron's resonant frequency.

If the magnetron has say eight fins (and therefore eight cavities), there will be four of these space charge curtains rotating around inside, moving between one fin and the next in about 0.2 nanoseconds (the time for one half-cycle at 2.45GHz). This is shown in Fig.2. Each curtain will make a full revolution every 1.63ns.

So the magnetron effectively works like a very rapidly rotating multi-pole switch, switching DC electrical power into the oscillating cavities – and potentially generating large amounts of microwave power in the process. It's a very compact and relatively efficient power converter.

Actually to ensure that everything happens as just described, there's one little detail inside the magnetron that I haven't mentioned yet. This is that there are circular *straps* used at each end of the magnetron's fins, to connect every every alternate fin together (Fig.2). The straps make sure that the oscillations of the various cavities are all synchronised together, and change polarities at the same time.

Incidentally the actual operating life of a magnetron is typically around 2000 hours.

The microwave power is extracted from the magnetron by connecting a tapping near the outer end of one anode fin. Generally the tapping lead comes out of the magnetron at the opposite end to the cathode heater leads. Its end forms a very short microwave transmitting antenna, used to couple the microwave energy into a *waveguide*. This is the microwave equivalent of a transmission line cable – at these frequencies, it becomes purely a rectangular metal pipe leading the microwaves to their destination.

In the case of a microwave oven, of course, the destination is the metal oven cavity itself, containing the food to be heated. Needless to say the oven cavity itself is also carefully designed to be resonant at 2.45GHz.

The basic physical arrangement of a microwave oven is therefore as shown in Fig.3. A power supply provides energy to the magnetron, which converts it into microwave energy. This is then led by the waveguide along and into the oven cavity, to heat the food.

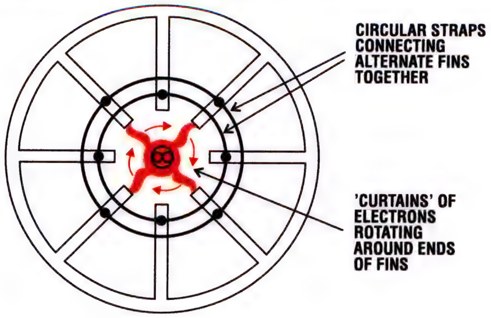

CIRCULAR STRAPS CONNECTING ALTERNATE FINS TOGETHER
'CURTAINS' OF ELECTRONS ROTATING AROUND ENDS OF FINS

**Fig.2:** *Inside the magnetron, electron 'curtains' rotate at high speed, acting rather like a commutator switch.*

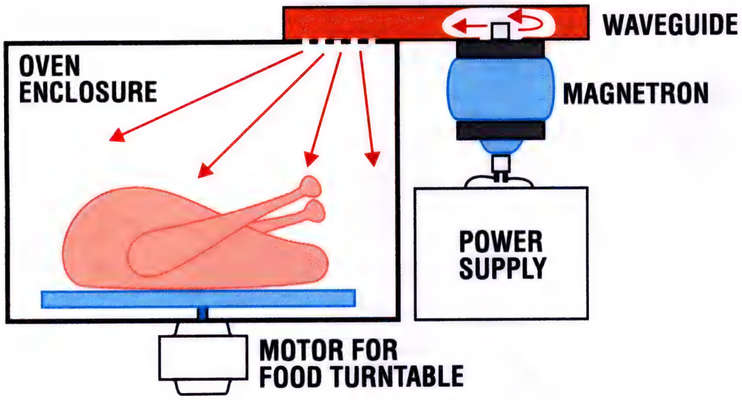


***Fig.3:** The main parts of a microwave oven. The food is rotated to ensure even heating from the microwave energy.*

Although the magnetron is relatively efficient in converting the input DC power into microwave energy, it is not perfect. The remaining power is dissipated as heat, in the magnetron itself. As a result the magnetron is usually mounted in a finned heatsink enclosure, with a small fan used to blow cooling air through the fins. It's this fan that generates most of the 'rushing air' noise evident when a microwave oven is operating.

## Simple circuit

The basic circuit of a microwave oven is shown in Fig.4. As you can see, it's pretty straightforward.

The magnetron itself is connected with its metal anode earthed. Its cathode and heater must therefore be connected to a supply of -4000V, with respect to earth. The actual heater leads are brought out of the magnetron enclosure via RF chokes and feedthrough capacitors, as shown, to prevent leakage of the microwave energy.

The heater itself typically operates from about 3.3V AC, supplied directly from a winding on the power transformer. The negative DC cathode voltage is derived from a high voltage secondary, via a simple 'half-cycle doubler' rectifier circuit. This consists essentially of capacitor C1 and diode D1.

It works as follows. When the top end of the transformer winding is positive, diode D1 conducts and capacitor C1 charges up with the polarity shown, to the peak value of the winding voltage. Then when the top of the winding swings negative, its voltage adds to that across the capacitor, boosting the voltage across D1 (and the magnetron) to a level equal to the full peak-to-peak voltage of the transformer winding.

As the transformer winding produces around 1400V RMS, the voltage applied to the magnetron is therefore approximately 4000V. Note, however, that this is not steady DC; it is essentially a 4000V peak-to-peak AC sinewave, superimposed on a -2000V DC level. So the magnetron actually only operates in short bursts, on alternate half-cycles of the 50Hz mains input.

The 10M resistor is a 'bleeder', to discharge capacitor C1 when the power is turned off. This is very important from the point of safety, especially for servicing personnel. The capacitor concerned typically has a value of 0.9uF, and carries a charge of 2000V DC. That means it stores just on two **joules** of energy – enough to kill an elephant, let alone a human.

In fact although the power supply inside a microwave oven is essentially quite a simple affair, don't forget that it's designed to deliver around a **KILOWATT** of power at 4000 volts. This makes it far and away the most dangerous power supply in any item of domestic equipment – bar none.

**So never underestimate the danger lurking inside a microwave oven's power supply. It won't just give you a nasty shock and throw you across the room, like a TV set's EHT supply. It's highly lethal, make no mistake!**

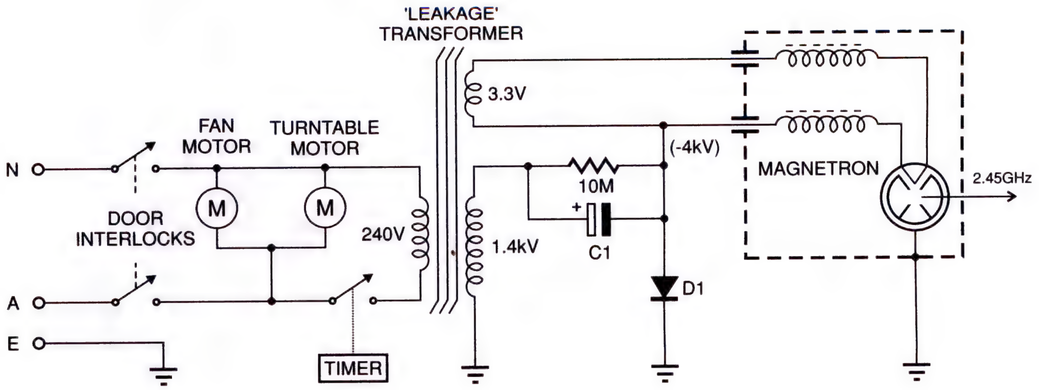
This in itself is a good reason to leave the repairing of your microwave oven to the manufacturer's service department, by the way. They also have the specialised test gear to ensure that the oven isn't leaking microwave energy – another potential danger.

Turning back to Fig.4 for a moment, you've probably noticed that the transformer is described as a 'leakage' transformer. This is because the current drawn by a magnetron tends to vary widely, for a small change in its applied voltage. In a microwave oven its current also tends to vary a lot due to changes in the loading on its microwave output, with different kinds of food in the oven.

To protect the magnetron from damage it is therefore desirable to provide the power supply with a measure of automatic current regulation. An elegant way of doing this is to give the transformer a high leakage inductance, usually by means of an air gap in the core.

A final note, regarding how the rated power level of a microwave oven is worked out. This is from the temperature rise in a 2000mL water load when it is heated for 168 seconds. The rated power level (in watts) is then found by multiplying the temperature rise (in degrees C) by 50.

***Fig.4:** The basic circuit used in most microwave ovens. Most differences arise with the 'timer' section.*



BY JIM ROWE

# Flexible Solid State Voice Recorder

It has no moving parts and no tape to rewind, but it can store up to 60 seconds of voice recording -- even when the power is turned off. This design for a solid state voice recorder is very flexible, too; you can configure it for either 'tape' or 'random access' mode for its message recording and replay.

**THEY MIGHT BE** used in all kinds of toys, telephone answering machines and other devices nowadays, but to an old timer like yours truly, there's still something a bit intriguing about solid state voice recorders. Even when you know how it's done, the ability to store up to a minute's worth of speech directly on a chip is quite impressive, don't you think?

There's no tape, no discs, in fact no moving parts at all. Just a circuit that samples the speech many times each second, and carefully stores the samples away in a big fat memory chip. The reverse process is then used to play them back, smoothly and reliably, whenever you wish.

This little project takes advantage of a very fancy chip that's designed especially for this kind of job. It does just about everything on-chip, and has memory for up to 60 seconds of recorded speech – which is stored in non-volatile memory, so that once recorded it isn't lost even when power is removed from the chip.

Another nice feature of the chip is that it can be easily configured to record and play the audio in a number of different modes. You can configure it to act like the electronic equivalent of a single length of tape, recording messages one after the other in serial fashion, or you can configure it as a 'random access' memory divided into either two, four or eight segments which can be recorded and played back independently.

Other options are the ability to enable or disable an 'auto rewind' function in tape mode, the ability to vary the sampling rate to choose the most suitable compromise between recording time and bandwidth, and the ability to run the recorder off either a 9-12V DC plug pack or a 6V battery supply. It's very flexible.

All of this is from a low cost circuit which uses just a handful of parts and fits on a tiny PC board. You can easily fit it all into a small plastic jiffy box, complete with speaker, electret microphone and recording/replay controls.

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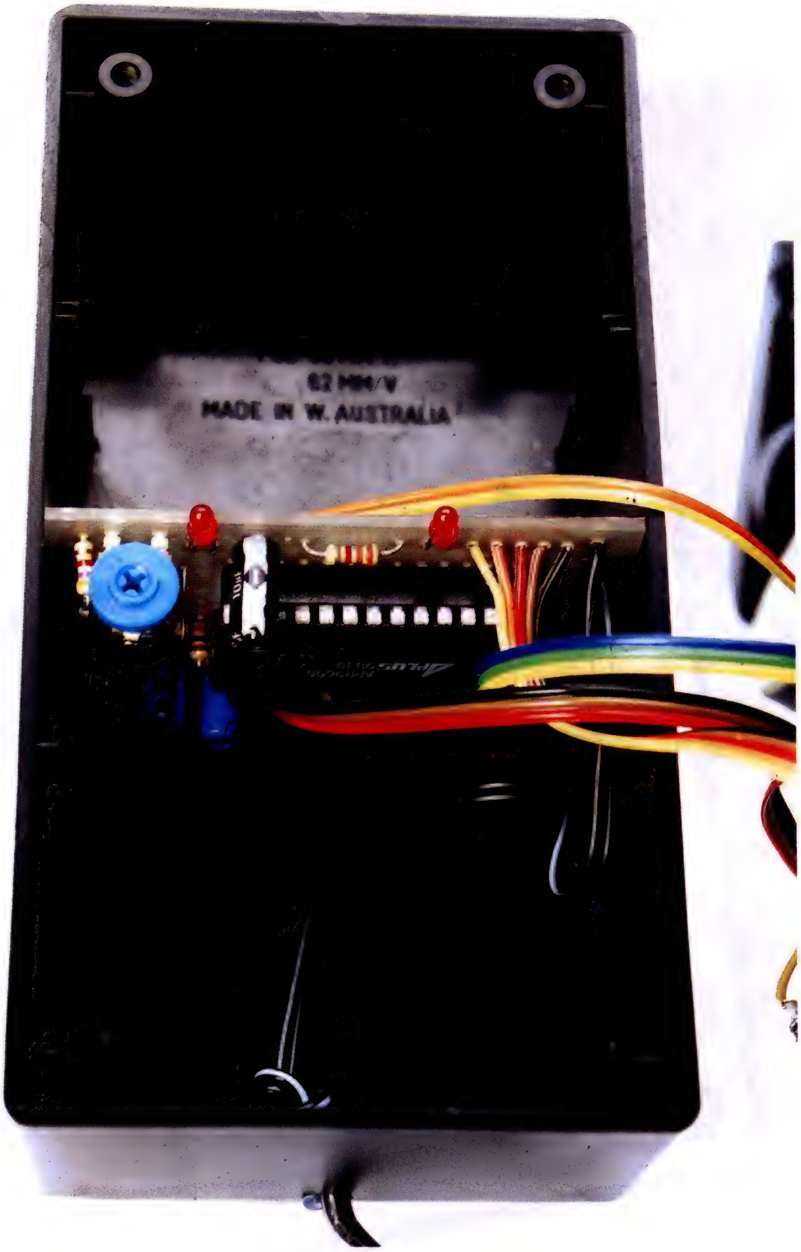
very compact but surprisingly flexible solid state voice recorder, that's just as suitable for use as a handheld message taker or to provide the 'voice' for a novel kid's toy. You could also program it to play any one of up to eight short spoken messages when the appropriate button is pressed – so it could be used to give callsign announcements on amateur radio repeaters, for example, or to make spoken IDs for the visually impaired when the buttons are pressed on an entry foyer console in an apartment block. Another use would be giving short descriptions of exhibits in a museum, when buttons are pressed on a display panel...

Incidentally this project is another one developed by the team at Oatley Electronics, and as a result kits for it will only be available from Oatley. However as usual Oatley has managed to keep the price of the kit down to a very attractive level; see the details in our parts list.

I should also add that although the basic recorder is designed to record and play messages under the control of pushbuttons, Oatley has developed a small interface board which allows its operation to be triggered by a logic signal if you wish. This would allow it to be hooked up to a security system, or perhaps connected to a PIR movement detector so that it makes spoken announcements whenever people walk into a specific area.

There are all kinds of possible uses for it, as you can see.



***Everything fits** on a very small PC board, apart from the speaker, electret mic, record/play switch and message select buttons.*

## How it works

At the heart of the recorder is the APR9600, a complete digital voice recording system on a single chip. It's made by Aplus Integrated Circuits Inc., a firm with its headquarters in Taiwan and a factory in Shenzhen, China.

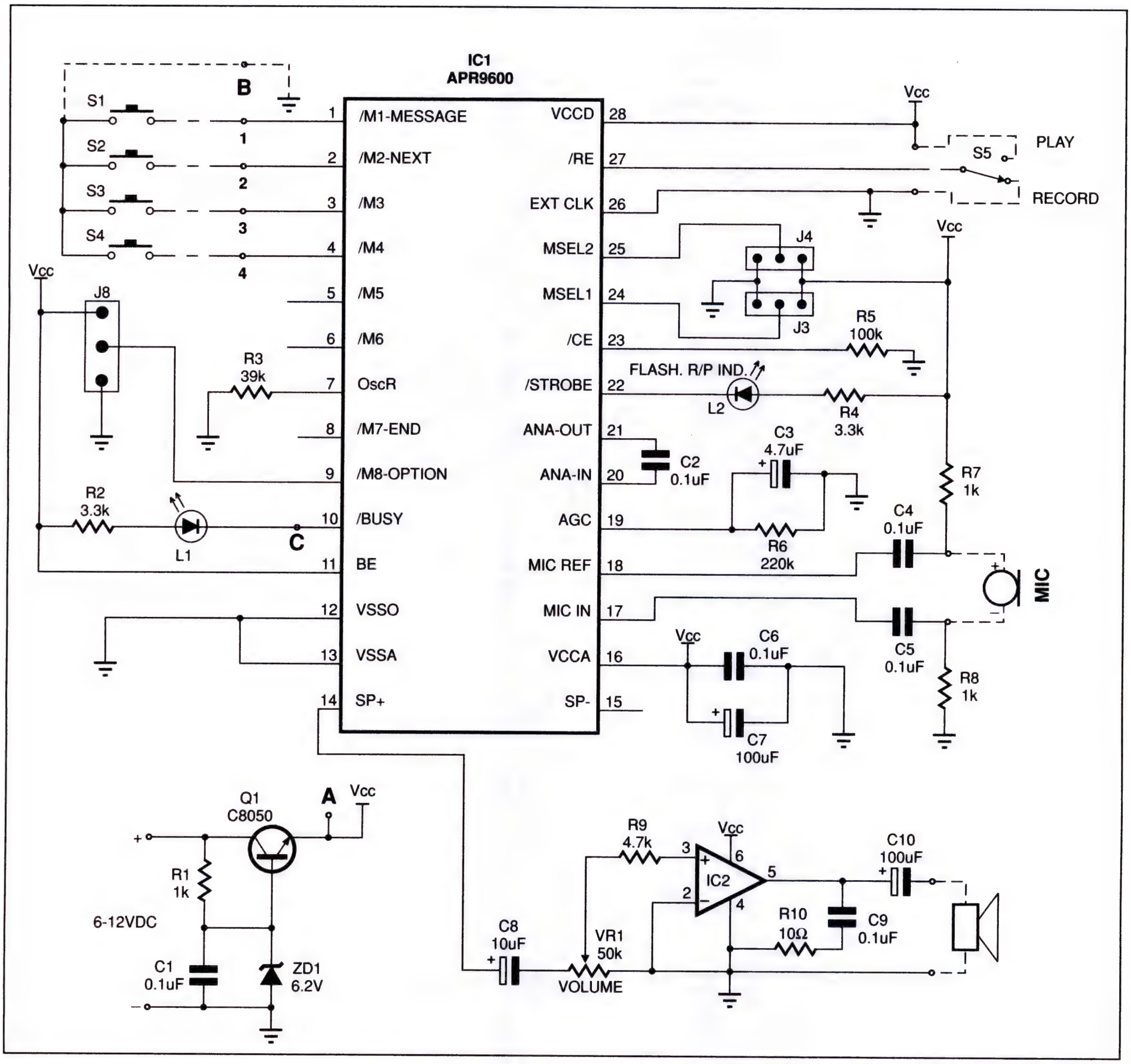
The APR9600 is a pretty complex beast, designed to take signals directly from an electret microphone for recording and deliver the replayed audio directly to a loudspeaker if you're happy with very low output. Here we're using a second LM386 audio amp chip to deliver a more satisfying output.

Inside the APR9600 there's a mic preamp and an automatic gain control (AGC) circuit for recording, along with an anti-aliasing filter and sample-hold circuit. The sampling circuit is clocked by an internal oscillator, whose frequency can be varied between approximately 4kHz and 8kHz to give a total recording time varying from 60 seconds down to 32 seconds, with a bandwidth varying from 2.1kHz to 4.0kHz.

The audio samples are then written directly into the chip's 256K memory, for recording. But this is no ordinary memory; it's described by Aplus as a 'flash EPROM analog storage array', where the samples are stored not as 8-bit digital samples, but apparently as 256-level analog samples. And because the memory uses a variant of flash EPROM technology, they're stored in non-volatile fashion. This means they don't evaporate when the power is removed; they simply remain there until the power is applied again. (You can still record over them, though.)

For replay, the samples are read back out again – non destructively – then passed through a low-pass filter for smoothing, and finally through an output amplifier.

Along with these basic audio signal processing and storage circuits, the APR9600 also contains mode and function control circuitry. This is



***All of the real work** is done by IC1, a complete digital recording system on a chip. IC2 is a standard audio amp chip to drive the speaker more effectively.*

used to determine which recording/play mode it's configured in, whether it's in recording or play mode, which memory segment is in use and so on.

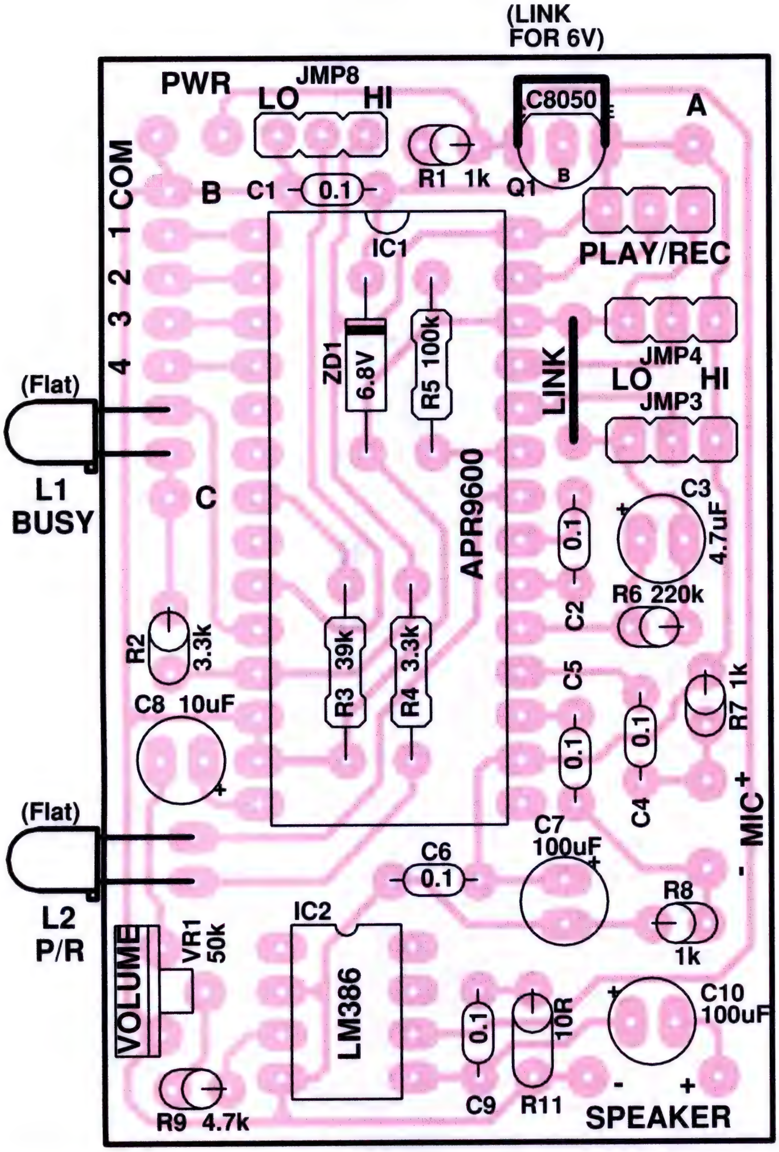
As you can see from the schematic, the APR9600 comes in a 28-pin DIL package. The audio from the electret microphone feeds directly into its internal recording preamp via pins 17 and 18, with coupling capacitors C4 and C5 used to block the electret's bias voltage. Components C3 and R6 connected to pin 19 are used to set the attack time of the chip's internal AGC circuit, and are optimised for speech.

The chip is configured for the various record/play modes mainly by the logic levels applied to pins 24 and 25, which are the 'mode select' pins. If either pin is high, the chip is in 'random access' mode. When only pin 25 is high, the memory is divided into two segments for two messages; when only pin 24 is high, it's divided into four segments for four messages; and when both pins are high, it's set for eight messages.

When *neither* pin 24 or 25 is set high (i.e., both low), the chip is then set for 'tape' mode. In this mode pin 9 also comes into the picture, and is used to select whether the chip does an 'auto rewind' of its virtual tape or not, after each recording. When pin 9 is low it doesn't rewind; when pin 9 is high it does.

As you can see, the circuit brings each of these three control pins out to a small header strip (JMP3, JMP4 and JMP8), so the chip's operating mode can be set very easily with jumper shunts. Note that for random access with four messages (the mode selected for the prototype recorder in the photos), these are set for high, low and high respectively.

In the random access modes, pins 1-6 and 8-9 of the chip are used to select which memory



***Here's the PCB overlay**, nice and large so you can see where everything goes. The two LEDs have their leads bent down against the top surface of the board. Opposite is the PCB etching diagram, actual size.*

segment/message is to be recorded or played back, as appropriate. So in two-message mode, only pins 1 and 2 are used; in four-message mode, pins 1-4; they're all used only in eight-message mode. As you can see pushbutton switches are used to connect the pins to earth, for both selecting the desired memory segment and triggering the chip into operation.

The logic level applied to pin 27 controls whether the chip is in record or playback mode. It's in playback mode if the pin is held high, or record mode when it's pulled low. As you can see we use switch S5 to control this pin, and this becomes our record/play control.

To record a message, you simply turn S5 to the record position and then **press and hold down** one of the message buttons, while speaking the message you want to record. The falling edge on the corresponding memory segment input pin triggers the chip into operation, and recording continues until you either release the button or the chip runs out of storage space in that memory segment. (It automatically stops recording, in that case.)

To play back the messages, you simply switch S5 to the play position and then press one of the message buttons briefly. This triggers the chip into playing back that recording.

As you can see the chip can drive two indicator LEDs to show its operating status. Pin 10 is used to drive a 'Busy' LED to show when it's active (i.e., either recording or playing back, as opposed to 'dozing'), while pin 22 is used to drive a 'Strobe' LED which blinks during either recording or playback.

The sampling rate of the chip's internal clock oscillator is set by the value of the resistor from pin 7 to earth. The resistor (R3) can be varied from 82k down to 24k, to vary the sampling rate between 4.2kS/s and 8.0kS/s. The value of 39k shown on the schematic is a good compromise, giving an audio bandwidth of about 3.2kHz and just over 40 seconds of total recording time.

When the APR9600 chip is replaying a message, the output audio appears at pins 14 and 15. Here we take the signal from pin 14, feeding it via coupling capacitor C8 to VR1, a preset pot used as a volume control. The output from VR1 then passes to IC2, an LM386 audio amp chip used to drive the speaker. Components R9, R10 and C9 are used to make sure IC2 is stable and gives clean amplification.

The APR9600 is designed to operate from a nominal 5-6V supply voltage, and here it's fed along with IC2 via a simple voltage regulator circuit using series-pass transistor Q1, with zener diode ZD1 providing 6.2V of base reference voltage. This gives a Vcc rail of about 5.6V for the two chips, for any DC input voltage between about 9V and 14V, as delivered by many plug packs.

It's easy enough to operate the complete circuit from a 6V battery, though (say four AA cells). To do this you merely leave out R1, C1, ZD1 and Q1, and replace the last of these with a wire link (between collector and emitter pads).

Capacitors C6 and C7 are used to bypass the supply pin for APR9600's audio circuitry (pin 16), and also the supply for IC2.

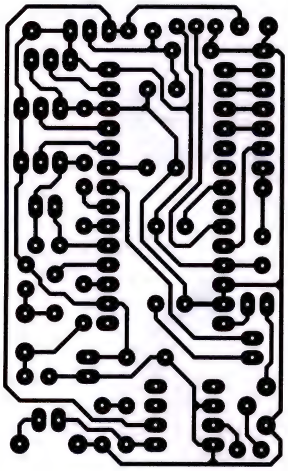
## Building it

Just about everything fits on a very small PC board, measuring a mere 63 x 39mm. The only components which mount off board are the speaker and microphone, the play/record switch and the message control pushbuttons.

The PC board is designed to mount vertically in a standard 130 x 67 x 42mm plastic utility box (UB-3), sliding into one of the moulded slots. The two indicator LEDs have their leads bent at

90° so their bodies are just beyond the top edge of the board, ready to protrude through matching holes in the box lid. All of the remaining off-board parts mount on the lid, and connect to the PCB via light hookup wire.

The overlay diagram shows where all of the on-board components go, and their orientation. Note that there's a small wire link on the board, which runs between JMP3/JMP4 and the socket for IC1. There are also four small components which mount on the board *under* the large IC socket: R3, R4, R5 and ZD1. These need to be fitted before the socket itself. (Don't forget that R1, C1, ZD1 and Q1 are all left out if you're going to be running the recorder from a 6V battery.) All of the remaining resistors are mounted vertically, to conserve space on the very small board. Bend their top lead back down carefully, to avoid straining the component.



Like the main recorder chip, IC2 fits in a socket as well to avoid component damage during soldering. Make sure you fit the sockets the correct way around, so their notches serve as a guide for adding in the chips themselves. Be careful too with orientation of the polarised electrolytics, LEDs and transistor.

Once all the components have been fitted to the board, you can prepare the box and its lid/front panel. The exact design and layout of the front panel is left to you, because it'll depend on which mode you choose for your recorder, and how many memory segments. You'll need a pushbutton for each memory segment you want in random access mode, but only two buttons if you choose tape mode – one for recording/replay triggering, and the other for 'rewind' (done by applying Vcc briefly to pin 23).

As you can see the prototype shown in the photos was set up for random access recording and four memory segments/messages, so it needed four buttons. The record/play switch and electret mic were mounted just above them (i.e., just below the PC board inside), and the speaker was mounted at the top. This is a fairly neat and practical arrangement.

The prototype was powered from a 9V plug pack, and the lead to the plug pack was taken out of the box via a small hole at the bottom, sealed around the lead using silastic.

## Checkout time

Once you've made all of the connections between the PC board and the off-board parts, it's time check it all out. Before applying power, though, give everything a final inspection to make sure you haven't fitted anything the wrong way around, or made any accidental solder bridges which could short things out.

Make sure too that you have the wiring made to the record-play switch correctly. Don't forget that miniature toggle switches work 'backwards' – the centre lug contacts the lug at the opposite end to the one where the toggle lever is 'pointing'. S5 should only connect pin 27 of IC1 to board earth in the *Record* position.

Next, make sure that you have the jumper shunts fitted to JMP3, JMP4 and JMP8 in the correct positions for the mode you want. If not, you may get some very odd results...

Now set the volume control pot VR1 to mid range, and apply the power from your plug pack or battery. You might like to check the voltage between pins 12-13 and pin 28 of IC1 with your DMM, to make sure that the Vcc rail voltage is close to 5.6V. (**If it isn't, switch off fast and check the orientation of Q1 and ZD1; you probably have one of them around the wrong way!**) Or 6V if you're using a battery, of course.

Now for the acid test. Try turning the record/play switch to Record, and then press one of your memory segment/message buttons and **hold it down**, while you recite a suitable test message into the electret mic. There's no need to get really close; it's quite sensitive. In fact if you get *too* close, you may well overload the mic or the recording chip.

The speaker should 'beep' at the start of recording, and during the recording the L1 should glow and L2 should blink on and off. Then when you stop recording by releasing the button, the LEDs should go dark again and the speaker will again beep.

If you try to record too long a message, the chip itself will terminate the recording and beep a couple of times to let you know that you've used up the available memory.

Once you've made the recording, turn the record/play switch back to Play, and briefly press the same button you used for recording. The recorder should play back the message you just recorded, showing that everything works. You may need to adjust the volume control pot though, to set the replay volume to a convenient level.

That's all there is to it. Your solid state voice recorder should now be complete, and ready for use. **ea**

## PARTS LIST

### ● resistors

| | |
|---|---|
| R1,7,8 | 1k |
| R2,4 | 3.3k |
| R3 | 39k |
| R5 | 100k |
| R6 | 220k |
| R9 | 4.7k |
| R10 | 10 ohms |
| VR1 | 50k vert. trimpot |

### ● capacitors

| | |
|---|---|
| C1,2,4,5,6,9 | 0.1uF monolithic |
| C3 | 4.7uF 10VW RB electrolytic |
| C7,10 | 100uF 10VW RB electrolytic |
| C8 | 10uF 10VW RB electrolytic |

### ● semiconductors

| | |
|---|---|
| IC1 | APR9600 voice recorder |
| IC2 | LM386 audio amp |
| Q1 | C8050 NPN transistor |
| ZD1 | 6.8V zener diode |
| L1,2 | 3mm red LEDs |

### ● miscellaneous

| | |
|---|---|
| JMP3,4,8 | Three-pin header strip |
| S1-4 | SPST pressbutton, normally open |
| S5 | SPDT toggle switch, miniature |

50mm speaker; electret microphone insert; PC board, 39 x 63mm; plastic utility box, 130 x 67 x 42mm; 9-12V DC plug pack supply or 6V battery; hookup wire, solder etc.

NOTE: Kits for this project will only be available from its developer, Oatley Electronics. The price for the K-162 Voice Recorder kit is $27.00, which includes the PC board, speaker, electret mic insert and all electronic components except the pushbuttons, R/P switch and power pack.

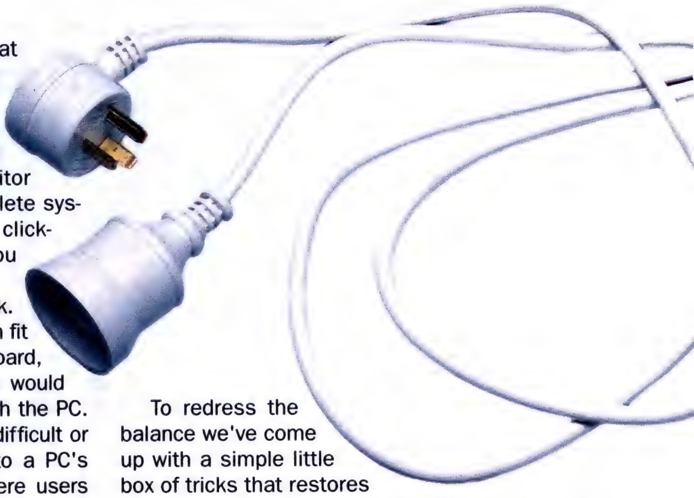
A plug pack supply suitable for powering the recorder is also available, for $6. In addition Oatley can supply a suitable plastic utility box for $4, miniature SPDT toggle switches for $1.50 each and SPST pushbuttons for 80c each.

All of these items can be ordered from Oatley Electronics at PO Box 89, Oatley NSW 2223, or by email to sales@oatleyelectronics.com. Please add $6 to cover packing and postage within Australia.

BY ROB EVANS

# Build the PC Powerup

Here's a small, inexpensive project that automatically powers up your monitor, printer and other computer peripherals when your PC is turned on, then turns them off as you shut the system down. It suits all types of PCs, and there's no need to dig around inside the machine to connect it either, as it simply plugs into a standard keyboard or USB port.



Back in the old days before ATX-format PCs or iMacs, most computers offered a simple, but undeniably useful socket on the back of the case – a 240VAC switched outlet. Normally, a matching IEC-style plug on the monitor was connected here so that the complete system would burst into life – well, start clicking and whirring, anyway – when you pushed the PC's power switch.

A most sensible idea, you might think. More enterprising PC owners would even fit an IEC plug to a four-way mains power board, so that *all* their computer peripherals would automatically fire up and shut down with the PC. The switched AC outlet wasn't really a difficult or particularly expensive feature to add to a PC's power supply, since in those days where users were happy to push a clunky mains-rated toggle switch, it was only a matter of internally wiring the power switch to the AC outlet socket.

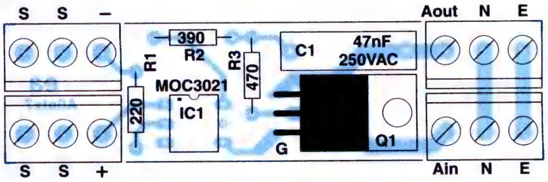
It was too practical to last...

Along came computer power supplies with the so-called 'soft' power-on feature, spurred along in the PC camp by the latest ATX (AT extended) motherboards and matching power supplies. With this arrangement, a small (and of course, suitably stylish) pushbutton switch merely triggers the power supply into action via a remote sensing line, so ultimately the PC *itself* comes to life – but that's all.

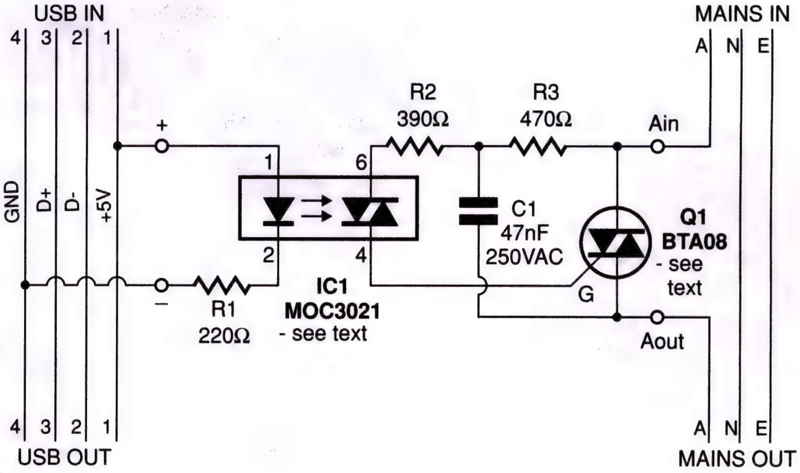
With this type of power supply the mains is always present and not switched, so the only way to add a 240VAC outlet feature would be for the manufacturers to include some kind of relay or triac switching system inside the supply. Some Macintosh PCs included this feature (the G3, for one), but presumably in the interests of keeping costs to a minimum, the majority of PC manufacturers simply dropped the idea of a switched 240VAC outlet.

To redress the balance we've come up with a simple little box of tricks that restores this feature to current PCs; the PC Powerup. In essence, the Powerup simply uses the PC's +5V line – tapped from the keyboard or USB port – to drive a triac, which in turn activates the unit's own 240VAC outlet.

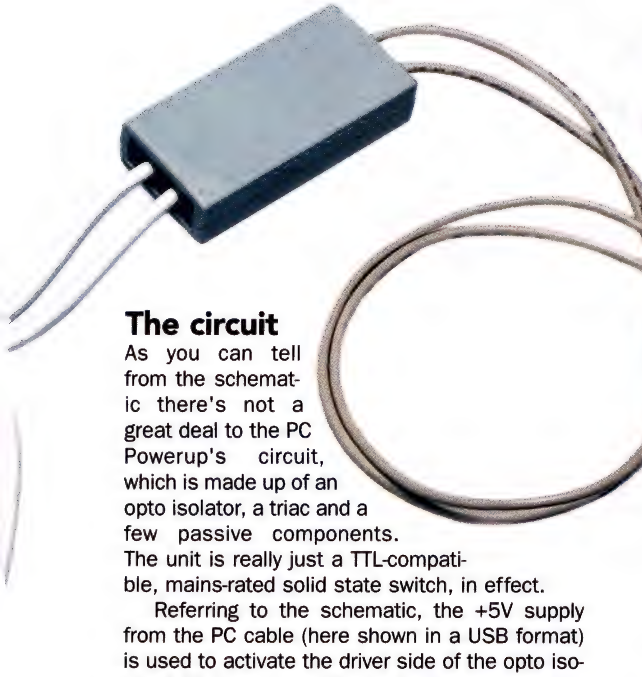
The Powerup solves the switchup problem in one hit, and since it can be connected to a conventional keyboard line (PS/2 or DIN-style) or a USB port, it's compatible with all of the current breed of PC and Macs. With a multi-outlet mains powerboard attached to the PC Powerup's output, you can again automatically control the power to your monitor, printer, powered speakers, scanner, and any other mains-powered peripheral attached to your system.



***Use the** component overlay diagram on the right when assembling the Powerup's PCB module. On the opposite page is the PCB pattern, reproduced at full size.*



***There's not much*** *to the PC Powerup's circuit (above): 5 volts from the PC cable activates the opto isolator, which in turn triggers the mains-switching triac Q1. Below are the pinouts for the three cable choices.*



## The circuit

As you can tell from the schematic there's not a great deal to the PC Powerup's circuit, which is made up of an opto isolator, a triac and a few passive components. The unit is really just a TTL-compatible, mains-rated solid state switch, in effect.

Referring to the schematic, the +5V supply from the PC cable (here shown in a USB format) is used to activate the driver side of the opto isolator IC1 (pins 1 and 2), via limiting resistor R1. This sets the IC's internal LED current to around 15mA, which is more than enough to fully activate the silicon bilateral switch (SBS) element on the opto's output side (pins 6 and 4). The MOC3021 device uses an infrared light path between the GaAs LED and the light-activated SBS, by the way.

The activated SBS now completes the path between the mains input active line and the triac (Q1) gate, via transient limiting resistors R2 and R3. Note that these resistors also form a snubber network with conjunction C1, which ensures reliable switching with 'difficult' inductive mains loads or where the mains itself is noisy – as is often the case around computer systems. With the triac now fully saturated, the path between the active in and active out lines is completed, activating the 240V mains outlet.

## Components

None of the PC Powerup's components are particularly critical, but there are a couple of aspects to be aware of.

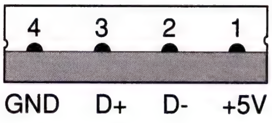
The first is the opto isolator itself. This must be the type that's intended for driving a triac (has an SBS device on the output side), and one that needs a current of 15mA or less through the LED for reliable operation. Note that the MOC3023 type, for example, needs around 30mA through the LED to latch the output, while the MOC3020 type requires just 5mA.

The potential danger here is that if the triac is not *fully* switched on by the opto isolator, the full mains cycle may not be switched through to the load. In this case, the unit would begin behaving more like a light dimmer, supplying a potentially damaging 'chopped' signal to the load – fine for light bulbs, but distressing for computer peripherals. So if you intend using an opto that needs a higher input current than 15mA, change the value of R1 accordingly.

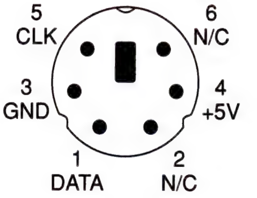
Along with the opto's LED current rating, the input/output isolation voltage should also be sufficient for the job. All of the common MOC302X series offer a 'primary to secondary' isolation rating of 5300V RMS, but for peace of mind you might like to check the specifications of any other opto isolator you use.

The other consideration for the PC Powerup's components is the ratings of the triac itself. We used a low-cost BTA08 600 type from SGS -Thomson, but a wide range of other triacs will do the job. The voltage rating must be sufficient to cope with the mains supply, and while the current needed to run typical

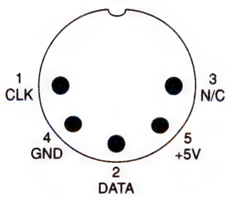
USB cable
- looking at plug

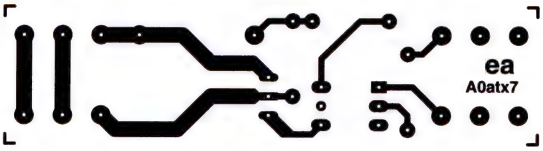


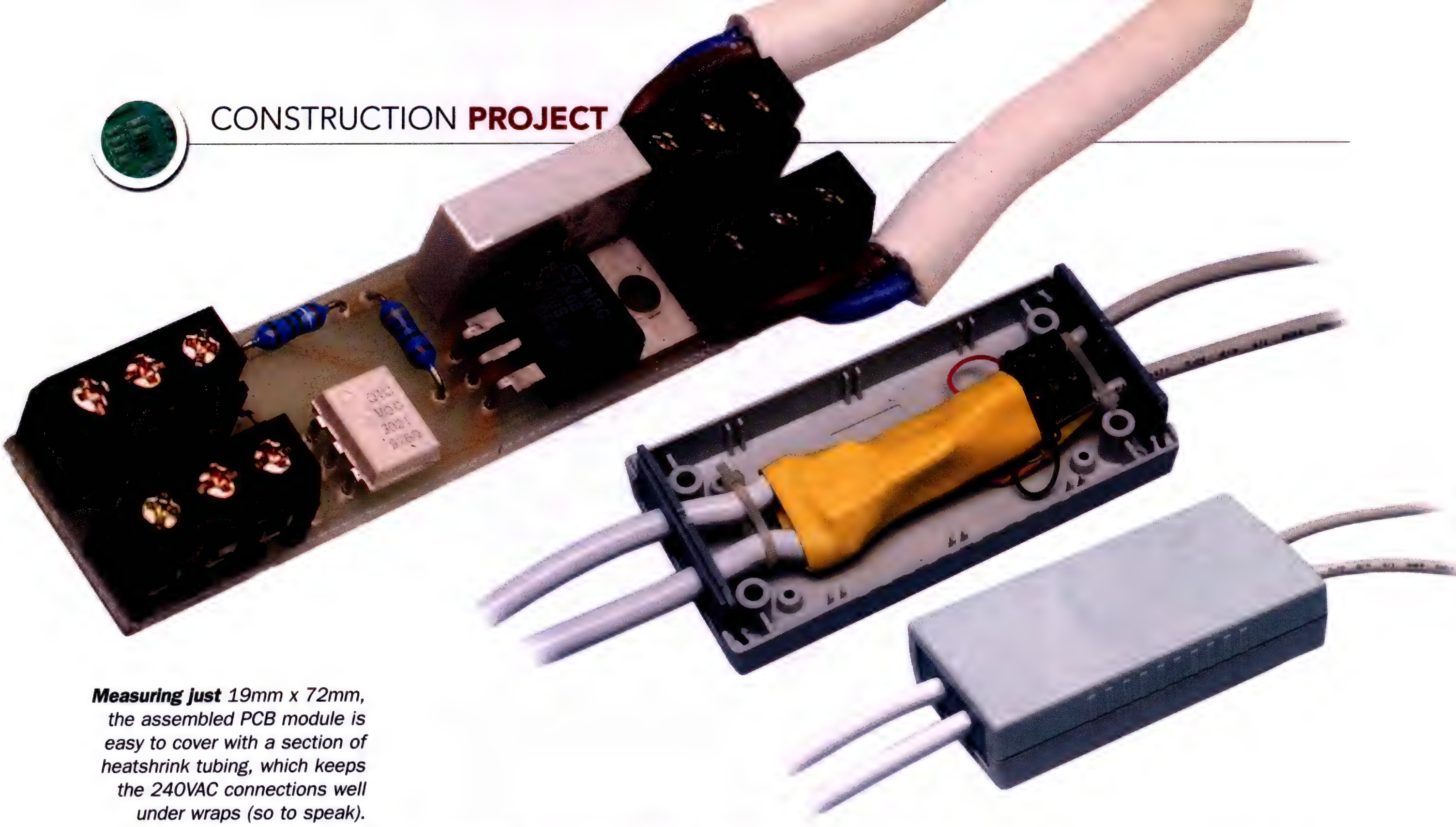
Keyboard extension cable
(6-pin PS/2 style)
- looking at plug



Keyboard extension cable
(5-pin DIN style)
- looking at plug







***Measuring just*** *19mm x 72mm, the assembled PCB module is easy to cover with a section of heatshrink tubing, which keeps the 240VAC connections well under wraps (so to speak). The wired up and insulated module is then clamped inside a standard plastic case.*

computer peripherals is not particularly high, the surge current (such as that taken by a monitor's degaussing coil) can be significant.

Fortunately most triacs offer a very high peak current capability, so a nominal rating of 8A or more should be fine. The BTA08 600 triac mentioned above is a 600V 8A device, as the type number implies, and a heatsink was not found to be necessary when the unit is switching power to typical PC peripherals.

## Construction

Not surprisingly, the most important factor to bear in mind when putting the PC Powerup together is that of safety. The circuit is dealing with the raw 240V mains supply, and like all projects involving triacs or relays switching the mains you need to take particular care with the wiring and insulation of all mains-related connections. Above all, **don't** connect the unit to the mains supply unless the circuit is fully insulated and preferably, fitted inside its plastic case.

As you can see from the shots of the prototype, we enclosed most of the PCB and connections (the 'bitey' end, in fact) inside a section of large heatshrink tubing, then clamped this module inside a standard 120 x 60 x 30mm plastic case. Note that no mains connections are exposed inside the case, and while we didn't use any screws or mounting bolts, some constructors may prefer to fit larger screw-down cable clamps.

All of the PC Powerup's components fit onto a small circuit board (19 x 72mm, coded A0atx7) while the external connections are made via small PCB-mount terminals, positioned at either end of the board. Start the construction by installing the resistors first while checking their values with a multimeter as you go, then fit the triac and opto isolator, and finally finish with the 47nF capacitor and the four PC-mount terminal strips.

At this point we'd highly recommend that you double check that all of the components are positioned correctly and well soldered, since faultfinding will be impractical once the module has been fully wired and sealed in its heatshrink sarcophagus. In particular, check that the opto isolator has been fitted with the correct orientation (pin 1 towards the centre of the board), and scrutinise the copper side of the board for bridged or damaged tracks.

Next, prepare the PC and mains cables so they can be wired to the PCB. Both sets of input/output leads are made by cutting a standard cable in half – or in whatever proportions suits your setup – since this turns out to be the most cost-effective way of making the Powerup's connections.

Now pass the mains and PC cables through matching holes in the box end panels, then terminate the mains connections as shown in the component overlay. Note that 'Ain' refers to the Active lead of mains input cable (from the plug), while the 'Aout' terminal connects to the Active of the mains output lead (the one with the socket) which ultimately powers the load. Once you're happy that the mains connections are correct, safe and secure the heatshrink tubing can be applied, leaving the only the PC connection terminals exposed.

At this point you'll need to refer to the diagrams to determine which wires in the PC cable are connected to +/- (5V in) terminals on the board. You can use the spare PCB terminal points (all labeled S, for spare) as junction connectors for the wires that go straight through (say, D+, D- and the shield on a USB cable), or these can just be directly soldered together and covered with heatshrink tubing.

Once you're happy with the Powerup's internal wiring, fit the module into the plastic case, securely lock the cables using cable ties or P-clamps, then assemble the case. The unit can be initially tested with a convenient load such as a desk lamp, then when you've determined that all is well, plug in your PC peripherals.

### PARTS LIST

| | |
|---|---|
| IC1 | MOC3021 triac opto isolator, or equiv. |
| Q1 | Triac, rated at 8A/400V or more |
| C1 | 47nF 250VW (mains-rated) capacitor |
| R1 | 220 ohm resistor |
| R2 | 390 ohm resistor |
| R3 | 470 ohm resistor |
| PCB 19mm x 72mm, coded A0atx7 | |
| Plastic case 120 x 60 x 30mm | |
| 4 x 3-way PC-mount screw terminals | |
| Choice of computer lead to suit: | |
| | USB cable |
| | keyboard extension (Standard DIN) |
| | keyboard extension (PS/2) |
| Mains extension cable | |
| Cable ties/clamps; heatshrink tubing, large and small. | |

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DARREN YATES

# Transistors – 2:
# Reading datasheets

This month, Darren looks at transistor datasheets, and how to choose the right device for your next project.

**LAST MONTH**, we looked at the basics of how bipolar junction transistors (BJTs) work and I said that there are many different types to choose from, depending on your application – power, radio frequency (RF), small-signal, low-noise, high-gain etc.

However, you're never going to get that information from just the part number on its own (unless you have a memory like a steel trap and you've been doing this for 20 years), so the easy way is to look up the spec sheets.

Catalogs such as those from Dick Smith Electronics and Jaycar Electronics have data pages up the back and these can be an invaluable source of quick information to help you choose the right transistor.

Fig.1 shows a brief section of a common data table. The info is correct, but it is only the tip of the iceberg as far as types go. We'll be using this table as we go through so we'll need to get to know it. Let's start by going through the categories:

- **Type** – the type number of the transistor.
- **POL** – polarity, whether it is PNP or NPN (you should remember this from last month).
- **Case conn.** – stands for 'case connections'; the table would normally have a list of pictures showing which pins of the transistor are which. Generally they are pictured looking at the transistor from below.
- **Vceo** – the maximum voltage between collector and emitter with no collector current flow.
- **Vcbo** – maximum voltage between base and collector with no collector current flow.
- **Ic max** – the maximum collector current the transistor can handle.
- **hfe @ Ic max** – AC signal gain of the transistor when the collector current is at maximum.
- **Ft (MHz) @ Ic (mA)** – the maximum frequency the transistor can handle and the collector current at which it can handle it.
- **Ptot** – maximum power the transistor can dissipate.
- **Application** – typical use for this device.

Sometimes, you may be designing a circuit around a component that you may have (bought in bulk at a bargain price for example) or designing a circuit and want to know the most suitable transistor for the job. You may even be looking to substitute a hard-to-find transistor with one more readily available type. This is a big topic that we'll look at later.

## Practical example

For now, let's assume that you're going to build the basic light switching circuit in Fig.2. It's just a basic two-transistor oscillator with a third transistor driving a 12VDC 24-watt light-globe at around 0.5Hz.

First off, we know that the circuit runs from a 12VDC supply, so the transistors we choose have to be able to handle an open collector-emitter voltage of at least 12V – looking at the table, there's no problem there.

The next thing is to work out which transistors are carrying the real current. The 1k collector resistors of transistors Q1 and Q2 pretty much gives away the fact that neither of these are really going to carry any more than about 12mA, and as we require NPN transistors for this part of the circuit, we can safely pick BC547 types to do this job. The reason is that they have a maximum collector current of 100mA – and we're nowhere near that.

We should also just check that they'll handle the power dissipation. Remember that these types can only dissipate 625mW of power and that's with a tailwind rolling downhill.

When transistors Q1 and Q2 turns on, there's less than 1V across the collector and emitter at absolute worst case and only for half the time as they switch on and off alternately – normally, it would be below 0.2V. Taking the worst case, the power dissipation would be 1V x 12mA = 12mW – basically you could operate this transistor, touch it and not notice any increase in temperature.

OK, transistor Q3 is one we need to think about. We know the load here is a 12VDC, 24-watt light-globe. The 24-watt rating means that it

***Fig.1:*** *This table gives you all the specifications you need. Almost.*

| Type | POL | Case conn. | Vceo | Vcbo | Ic max | hfe @ Ic max | Ft (MHz) @ IC (mA) | Ptot | Application |
|---|---|---|---|---|---|---|---|---|---|
| BC327 | PNP | TO-92 (17) | 45 | 50 | 800mA | 100min @ 100mA | 260MHz @ 10mA | 625mW | Low-power output, general purpose |
| BC337 | NPN | TO-92 (17) | 45 | 50 | 800mA | 100min @ 100mA | 210MHz @ 10mA | 625mW | Low-power output, general purpose |
| BC547 | NPN | TO-92 (17) | 45 | 50 | 100mA | 125min @ 2mA | 300MHz @ 10mA | 625mW | Low-power output, general purpose |
| BC557 | PNP | TO-92 (17) | 45 | 50 | 100mA | 75min @ 2mA | 200MHz @ 10mA | 625mW | Low-power output, general purpose |
| BD139 | NPN | TO-225 | 80 | 100 | 1.5A | 40min @ 150mA | (not specified) | 1.25W | Audio driver, low-power |
| TIP31 | NPN | TO-220 | 40 | 40 | 3A | 25min @ 1A | 3MHz @ 500mA | 40W | Power switch & amp |
| MJ15004 | PNP | TO-3 | 140 | 140 | 20A | 25min @ 5A | 2MHz @ 500mA | 250W | High power audio & switch |

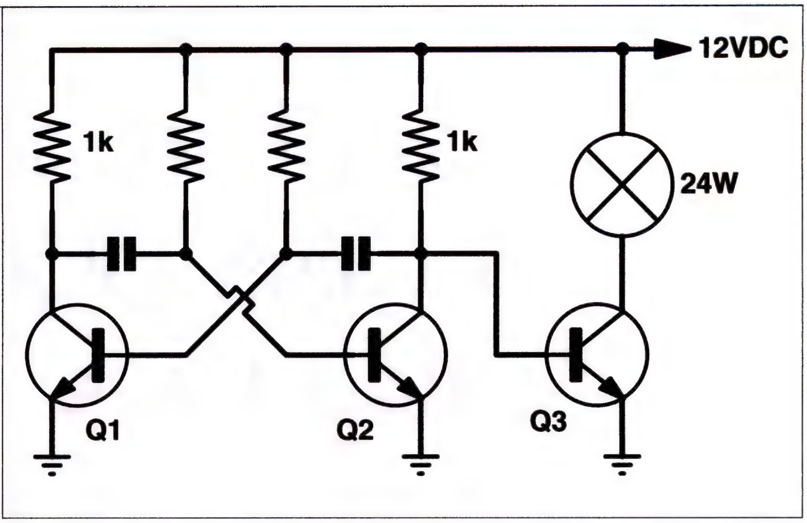


***Fig. 2:** It's a simple transistor oscillator, right? But which transistors will you use? and what about the heatsinking for Q3? Bet you didn't think of that one...*

requires two amps of current to run it.

Checking the maximum collector current of this transistor now takes on new importance. From the table, we need only look at the NPN types.

BC547, BC337 and BD139 types are out because they all have a maximum collector current of one amp or less. The TIP31 type looks good with its three-amp collector current rating.

Again, the power rating isn't a worry as even at a worst case of one-volt collector-emitter voltage when the globe is on, we're only dissipating: **Pd = Vce x Ic** = 1 x 2 = two watts

## Heat dissipation

Two watts – that's enough power to make me think we may need a heatsink. Unfortunately, this table doesn't tell us anything about the thermal resistance of the transistor; transistors are not perfect devices and turn some of the electrical energy into heat.

The amount of heat is measured in °C per watt and the good transistor tables will actually give you this rating plus the maximum temperature the device can handle.

You probably thinking then that this table isn't all that useful – and you're not far off. The reason I used this is to show you that you won't always find every bit of information needed in every table, particularly if you're relying on electronics store catalogs for your information alone...

What you should invest in is a transistor data book, of which, there are a few around in most electronics shops. However, here's a way to get around this problem in this case.

To work out the temperature rise of the transistor with a given amount of power dissipation, you need to know the junction-to-case (j-c) thermal resistance of the transistor, the thermal resistance between the case and the heatsink, the thermal resistance between the heatsink and the air, the maximum operating junction temperature of the transistor, the ambient temperature, and the power to be dissipated by the transistor.

We know that the transistor is a TO-220 type – TO-220 transistors generally have a thermal resistance between the junction inside the transistor and the transistor case of around 3°C/W.

Without further information, and to make this circuit reliable, we should try and keep the transistor junction temperature below 100°C.

At worst case, we can assume in this instance a thermal resistance between the heatsink and the case of no more than 0.2°C/W if we use heatsink compound between the transistor case and the heatsink – it's almost small enough to disregard but for the sake of being complete, we'll include it.

Because we're trying to get the heat out of the transistor junction connection and out into the air, we need to know the overall thermal resistance from the transistor junction to the air and that is: **Rth-all = Rth (j-c) + Rth (c-s) + Rth (s-a)**, where "j-c" is junction to case, "c-s" is case to heatsink and "s-a" is heatsink to air.

We know the maximum power dissipation is also: **Pdmax = (Tjmax - Tamb)/Rth-all**, where Tjmax is the maximum junction temperature, Tamb is the ambient temperature and Rth-all is the overall thermal resistance from the transistor junction to the air.

Tamb is generally taken as 25°C in most cases, and we've decided on the conservative value of 100°C for the junction temperature inside the transistor.

We now know all of the parameters except one – the heatsink rating. Juggling the equations around, we end up with:

**Rth (s-a) = {(Tjmax - Tamb) - Pdmax (Rth[j-c] + Rth[c-s])}/Pdmax** = [(100-25)-2(3+0.2)]/2 = 34.3°C/W.

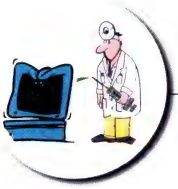
That means we can choose any heatsink so long as it has a rating of 34.3°/W or lower. A quick look through the Jaycar catalog shows HH-8502 with its 20°C/W rating is more than enough. Remember, the bigger the heatsink the smaller the rating but you don't want to go overboard because it just adds to the price.

Remember too that we've been playing the 'devil's advocate' in our design and taken worst-case scenarios. We could have chosen a brick of a heatsink for this circuit and it would have done the job, but with the right knowledge and a little maths, we've been able to calculate that a tiny 81-cent heatsink will also do the job.

If we knew the actual maximum junction temperature for the TIP31 transistor, we'd probably be even be able to do without a heatsink altogether but that's pushing things a little too far. You'll find that 100°C is a pretty good conservative figure to use for a TO-220 type.

I always find these articles take on a life of their own and we have digressed from transistor data tables a bit but in doing so, I hope you can see how important these data tables become when you're working out the design of your circuit.

We'll continue on with our look at this circuit next time. See you then. **ea**



BY JEAN BAPTISTE CATTLEY

# Proxy filtering, Devilish DCC, killing keys, and more...

## Just add 91.89...

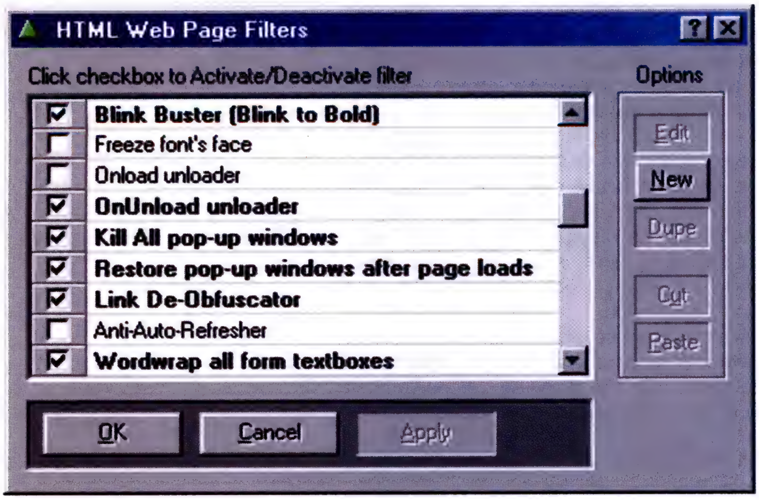
**I want to change my laptop from Win 3.11 to Win95. I have taken all relevant software off the system and there is nothing I need left on the drive. I have a brand new win 95 CD, not an upgrade, but I am not quite sure how to install from scratch. Can you help me?**

*(Chris Harvey, via email)*

Sure can. First, you'll need your CD-ROM drivers on a bootable floppy. Since your CD is already (I presume) working under Windows 3.1, you will already have them installed on your system. First, FORMAT A: /S to make a clean bootable floppy, and then copy across FORMAT.COM from your laptop's DOS directory.

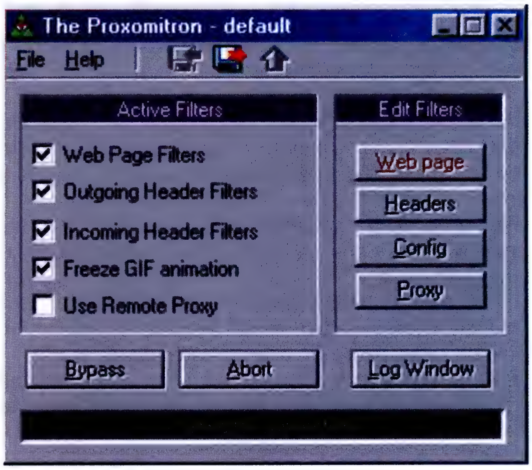
Open up C:\CONFIG.SYS and C:\AUTOEXEC.BAT in Notepad or such, and find the lines that load in the driver. In CONFIG.SYS you should see a DEVICE entry, such as DEVICE=SBIDE.SYS /D MSCD001 /P: 170,15 (or something similar, I can't tell you exactly without seeing your system.) Copy this line to a new, blank CONFIG.SYS on A:\, and also copy the driver file itself (which would be SBIDE.SYS in this example) onto A:\.

Now go looking in AUTOEXEC.BAT for the line with MSCDEX in it, the other half of the driver pair used for your CD. Copy this line to a new AUTOEXEC.BAT on A:\, and reboot off the floppy. With any luck, you should boot to the DOS prompt, and be able to access your CD from there. Once you can do this, you're ready to format your hard drive.



☑ Blink Buster (Blink to Bold)
☐ Freeze font's face
☐ Onload unloader
☑ OnUnload unloader
☑ Kill All pop-up windows
☑ Restore pop-up windows after page loads
☑ Link De-Obfuscator
☐ Anti-Auto-Refresher
☑ Wordwrap all form textboxes

***Popup ads**, exit consoles and other unclean HTML, BE THOU GONE FROM HERE!*



☑ Web Page Filters
☑ Outgoing Header Filters
☑ Incoming Header Filters
☑ Freeze GIF animation
☐ Use Remote Proxy

Cross your fingers, ask any passing deities to put in a word for you, and (having booted off the floppy) FORMAT C: . Once this traumatic procedure is done with, you're ready to install 95. If you have room on your hard drive, and want to save scrabbling around for the CD in future, MD C:\CABS, then COPY D:\WIN95\*.* C:\CABS. This will copy all the installation files to your local machine, so you have them instantly to hand whenever you change system components. Now run SETUP.EXE from C:\CABS. (or off the root of the CD if you didn't copy the files across.) The installation procedure is designed to hold your hand as much as possible, so there's really nothing I need to tell you – just follow the prompts and you can't go wrong.

## Pretty proxy

Have you ever found a really good website that has all you want – but with really annoying javascript popups? Can't stand getting stuck in frames? Do fancy mouseover graphics get your goat? Ever wish the stupid thing would stop auto-refreshing just when you're trying to read it? Vowed to kill someone the next time closing one window opens another? Ever...

Well, you get the picture. The fact is, there are some incredibly damned annoying web pages out there, and they don't have to be that way. Short of long-distance violence, you might think there's nothing the poor user can do about it – but you'd be wrong.

Enter the Proximotron. This impressive-sounding applet acts as a filtering proxy, right on your own computer. Born in the unpleasant background of censorware, the Proximotron filters the web pages that come into your computer, stripping out anything you find offensive – never mind sleazy subjects, neo-Nazi propaganda or bomb recipes, the Proximotron allows you to zap **any** text at all.

This includes HTML tags, javascript code, cookies – even the browser info and the referred-by tags that get sent to CGI scripts that tell sites where you've been and who sent you... There's very little you can't control with the thing, so whether you're paranoid about privacy, fanatical about frames or just very, very picky about colour schemes, you can now surf in your own personal style, no matter what people throw at you.

Simply point your web browser's proxy setting at your local machine, and enable any of the 50 inbuilt filters, and you're away. If the built-in filters aren't to our satisfaction, you can define your own – can you ask for more? Oh, all right... it's free! (as if you hadn't guessed.) Go grab it now at **http://proximotron.cjb.net**.

## Using DCC

**Back in the good old days (?) of DOS, I was able to connect two computers by using the InterLink program and what I think was called a 'Laplink' cable. Having made the connection, it was easy to access the drive(s) on one computer from the other and to transfer files between the computers.**

**I would like to do the same thing with Win95/98 computers but I am not sure how to go about it. I have tried using the 'Direct Cable Connection' utility which comes with windows and my old Laplink cable. I get most of the way through the setup but I can not get the computers to share files.**

**Am I using the wrong sort of cable? I would appreciate any help you can give me on this. Specifically I am trying to connect a laptop running Win98 to a desktop PC clone running Win95B**

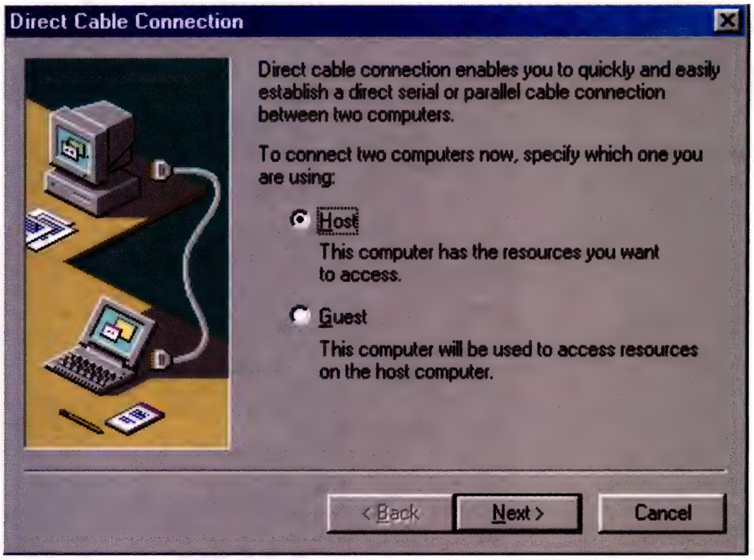
*(Paul Van Pinxteren, via email)*

I'm afraid to say that your first mistake comes from trying to use Direct Cable Connection. It's about the pickiest communications protocol in existence – it usually works on Thursday afternoons – if there isn't an 'R' in the month (and you're wearing your lucky socks). However, if you really can't borrow a couple of network cards (or, gods forbid, a null modem and HyperTerminal), then you can but try the following...

First, you'll need the right cables. Check out Fig.1 and Fig.2 for serial and parallel pinouts. If you use a parallel cable, make sure the port type in the BIOS setup is the same on both ends – EPP gives better throughput than Standard mode, but I've had some peripherals act oddly in EPP mode, so it's up to you.

Now you'll need to have your software components set up. You'll need Direct Cable Connection (obviously) and Dial-Up Networking from the Add/Remove Programs control panel, and Client for Microsoft Networks, Dial-Up Adapter, NetBEUI and File and Printer Sharing for Microsoft Networks in the Network control panel (whew!).

On the host computer (the one with files you want to share (the connection is effectively one-way; you can only share files in one direction, without a *lot* of mucking around) you'll want to go to Properties of File and Printer Sharing, and set the Browse Master property to



Direct Cable Connection

Direct cable connection enables you to quickly and easily establish a direct serial or parallel cable connection between two computers.

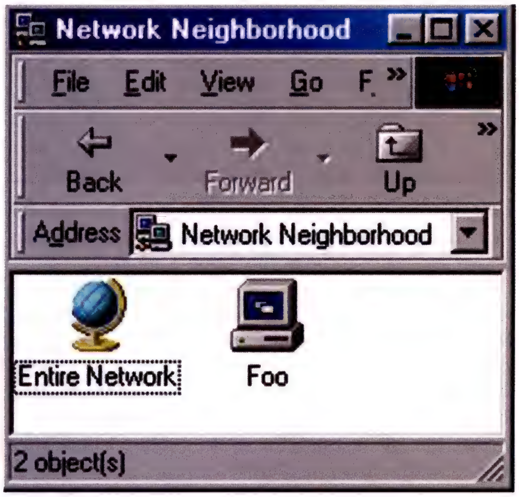
To connect two computers now, specify which one you are using:

● Host

This computer has the resources you want to access.

○ Guest

This computer will be used to access resources on the host computer.



***The Guest*** *computer can see the Host, but not vice-versa... Just one more reason why I never liked DCC.*

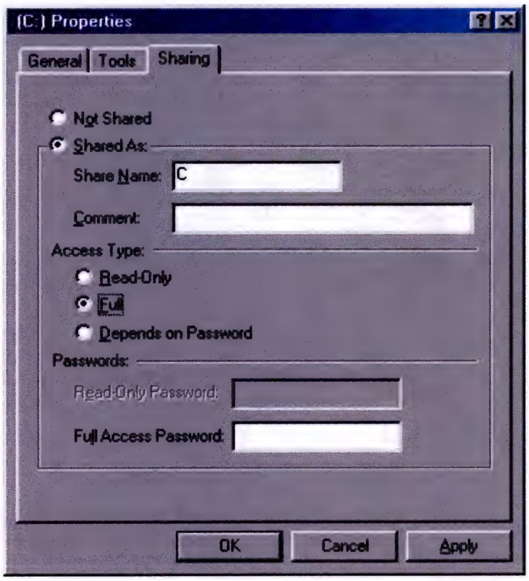
| Signal: | 9-Pin | 25-pin | 25-pin | 9-pin | Signal |
|---|---|---|---|---|---|
| Ground | 5 | 7 | 7 | 5 | Ground |
| Transmit | 3 | 2 | 3 | 2 | Receive |
| Receive | 2 | 3 | 2 | 3 | Transmit |
| RTS | 7 | 4 | 5 | 8 | CTS |
| DSR,CD | 1,6 | 6,8 | 20 | 4 | DTR |
| CTS | 8 | 5 | 4 | 7 | RTS |
| DTR | 4 | 20 | 6,8 | 6,1 | DSR,CD |

| Signal: | 25-Pin | 25-Pin | Signal |
|---|---|---|---|
| D0 | 2 | 15 | Err |
| D1 | 3 | 13 | Sel |
| D2 | 4 | 12 | Paper out |
| D3 | 5 | 10 | Ack |
| D4 | 6 | 11 | Busy |
| Err | 15 | 2 | D0 |
| Sel | 13 | 3 | D1 |
| Paper out | 12 | 4 | D2 |
| Ack. | 10 | 5 | D3 |
| Busy | 11 | 6 | D4 |
| Gnd | 25 | 25 | Gnd |

***Above:*** *Pinout for a serial DCC cable.*

***Left:*** *The pinout for a parallel DCC cable. Parallel DCC is a lot faster, but can be harder to get working...*

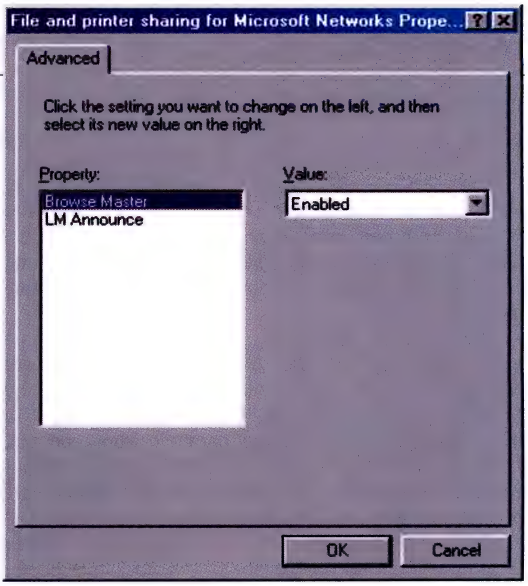
*Sharing a drive, Setting the Host as Browse Master, and praying for the whole thing to work.*



(C:) Properties

General | Tools | Sharing

○ Not Shared
● Shared As:
Share Name: C
Comment:
Access Type:
○ Read-Only
● Full
○ Depends on Password
Passwords:
Read-Only Password:
Full Access Password:



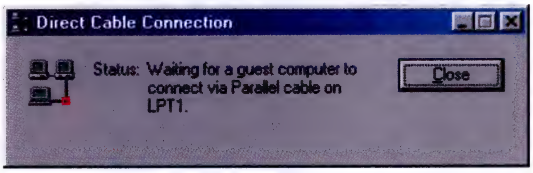
File and printer sharing for Microsoft Networks Prope...

Advanced

Click the setting you want to change on the left, and then select its new value on the right.

Property:
Browse Master
LM Announce

Value: Enabled



Direct Cable Connection

Status: Waiting for a guest computer to connect via Parallel cable on LPT1.

Enabled. Set up the Identification tab of the Network properties so that each computer has a unique computer name, but both use the same workgroup.

Once you've done all this and rebooted (both machines), select the drives on the Host machine that you want to make available, right-click and go to Properties | Sharing, and set it up for shared access. Now you're theoretically ready to try running up Direct Cable Connection.

Run the utility from the Start menu, select Host mode and the port you want to use, and start listening. Now repeat the procedure on the other machine, using Guest mode, and (if you've been a good boy all year) the machines will connect, and the Guest computer will be able to see the Host machine in Network Neighbourhood, and share files, even map a drive as though it were a real network...

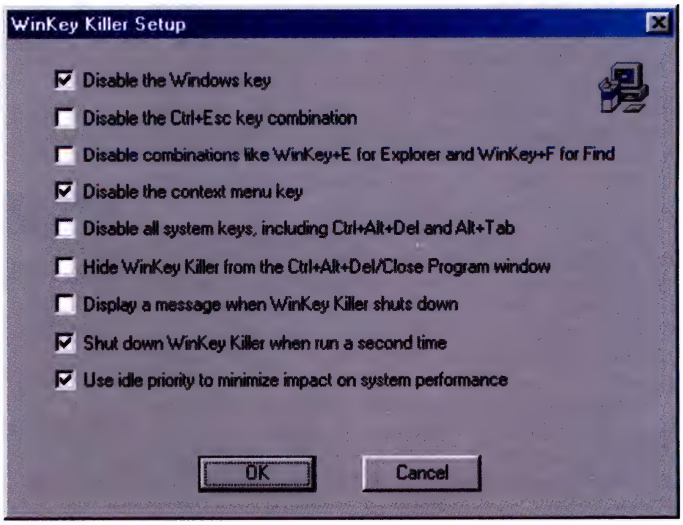
Frankly, I always thought it was way too much hassle, especially considering that it rarely if ever works the way you expect it to. Now, I'm not often serious about the inferiority of Microsoft products, but this is a perfect case in point – it's tedious, it's balky, it's frustrating, and it's very, very limited in functionality. If you just want a few files across, you're probably best off booting to DOS and using good old Laplink. Or swapping hard drives. Or getting a couple of network cards. Or getting on the internet and mailing them to your other computer. Or copying them out by hand...

Ok, ok, it's not that bad, I just spent all night once trying to get it working on one particularly uncooperative machine, and it left me bitter and twisted and ready to kill small furry animals. I'm better now, really. Now where did I put that machete?

## Kill the key

While I'm on the subject of homicidally irritating things, I might just mention the glorious Windows key that most keyboards nowadays have. This marvellous invention allows you to pop up the Start menu just as you're doing something very delicate with the Alt key - such as defining a mask in Photoshop, or lining up a rocket launcher in Quake, completely wrecking your concentration, causing all kinds of awful things to happen...

Well, thankfully, there's a way around this, called Winkey Killer. This tiny (9K! now that's the size utilities should be!) little utility simply disables your Windows and Menu key... perfect! No muss, no fuss, and of course, it's free. Go grab yourself a copy, at **http://www.zdnet.com/downloads/stories/info/0,,000XE1,.html** and your children and pets will be safe once more from flying keyboards. Just one thing – I've recently (ok, so I'm slow) discovered that tapping Windows-M minimises all windows without having to fiddle around right-clicking the taskbar – that's handy enough not to run WinKey Killer... almost. ea



WinKey Killer Setup

☑ Disable the Windows key
☐ Disable the Ctrl+Esc key combination
☐ Disable combinations like WinKey+E for Explorer and WinKey+F for Find
☑ Disable the context menu key
☐ Disable all system keys, including Ctrl+Alt+Del and Alt+Tab
☐ Hide WinKey Killer from the Ctrl+Alt+Del/Close Program window
☐ Display a message when WinKey Killer shuts down
☑ Shut down WinKey Killer when run a second time
☑ Use idle priority to minimize impact on system performance

# Low-dropout
# 5V regulator

The SGS-Thompson LD1117V50 is a low-dropout 5V voltage regulator that can supply up to 800mA. Its use of PNP instead of the more usual NPN pass transistors within the device allow its quiescent current to flow through the load, increasing efficiency.

Of perhaps more interest to designers, is the fact that it is pin-for-pin compatible with standard fixed-voltage regulators such as the ubiquitous LM7805T, and of course its low drop-out voltage of only 1.0V. It offers full current limiting, and overload protection, and can withstand up to 15V across its input.

You can pick one up from Dick Smith Electronics (Cat # Z-6601) for $2.95, along with a data sheet with full device specifications, and check out the similarly named LD1117V (Cat # Z-6622) 1.25 - 15V adjustable low-dropout voltage regulator while you're at it. **ea**

## SPECIFICATIONS

| | |
|---|---|
| Max DC input voltage: | 15V |
| Output voltage: | 5.0V |
| Max output current: | 800mA |
| Dropout voltage: | 1.1V @ Io = 800mA |
| Quiescent current: | 10mA (Vin = 15V) |
| Load regulation: | 15mV @ Io = 800mA |

# VINTAGE RADIO

BY ROGER JOHNSON

# Four-Valve Sets - Part 1

In the 1920s, the four-valve radio was very popular in Australia because while reasonably priced, it gave good selectivity and sufficient audio power to be able to listen to interstate stations. There were some interesting designs in those early years, as we'll see.

**IN THUMBING THROUGH** volume 1 of Alan Douglas's book *Radio Manufacturers of the 1930's* (Vestal Press, New York, 1988), it is hard to spot a four valve receiver. Yes they are there, but by far the more numerous are five-valve-plus radios, in many a fancy cabinet and with price tags to match.

Amrad, early Crosley 'combination sets', Cutting and Washington, Dayfan and some of the other US brands did have four-valve sets in their product range, but you certainly have to look hard to find them. This is quite different from the Australian market of the same time, and it is difficult to imagine why. Perhaps the higher relative affluence in the United States meant that radio was more of a status symbol – whereby you bragged to your neighbour that "my radio has seven tubes", and so on.

Two of the early starters with a four-valve radio and which were household names are Atwater Kent and Browning Drake. Atwater Kent offered the 'breadboard' models 4052 and 4066, as part of the seven available models for the 1922/3 season. These curious sets had but one tuning circuit. Atwater Kent chose not to pay the royalties for regeneration or neutralisation. Instead, the stage ahead of the detector could be made regenerative by the owner – if he purchased a regenerative unit, wired it in himself and replaced the untuned RF coupler! (From Douglas, *Radio Manufacturers of the 1920's*, Vol.1.)

Atwater Kent's more recognisable four-tube sets are the breadboard model 9 and the compact model 19, each with a single tuning stage ahead of the tuned detector followed by two stages of audio. There was no regeneration or neutralisation of the RF stage.

However Atwater Kents were not sold in Australia until the model 20C. To be more locally minded, one of the earlier recognisable four-valve sets of significance was the Browning Drake. This receiver has already been covered in this column by Peter Lankshear, with details on how to rebuild one (November-December 1994).

The two RF plus two audio stage lineup is/was standard fare for the four-valve radios in this country, where four valvers seem to have always been in more relative abundance than the United States. That is certainly true in the early years, if thumbing through the advertisements of the popular magazines of the 1925 to 1928 era for all-triode radios is any guide. There is, however, some variation in how these sets were achieved.

## 'Tuned anode'

This type of receiver enjoyed considerable popularity in the period 1925/6. As the name implies, the second tuned circuit is in the anode of the RF amplifier rather in the grid circuit of the detector stage. One such circuit which appeared in the *South Australian Wireless and Radio Weekly* for August 26, 1925 is shown in Fig.1. Needless to say, there is a fairly apparent omission: the grid capacitor and grid leak for the detector stage (second valve).

These items are definitely part of the circuit because they are discussed in the text. However, this circuit is an example of the typographical and draughting errors that occurred in radio magazines of the mid 1920s. While we may politely smile today, producing such a magazine must have had its problems – no doubt on a shoe-string budget and in all probability with a staff of two (a printer and 'the rest').

Back to the circuit. The text is only one page in length, with a goodly portion of that page devoted to preparing the panel to make it look nice. There is no parts list or wiring diagram, and only a postage stamp sketch of the panel layout. We have deduced that there would be a grid leak and capacitor, but the arrangement of the coils is puzzling.

The circuit suggests that reaction is achieved from the detector stage to the tuned anode coil by means of a vario-coupler. The panel sketch suggests honeycomb coils are used, and the coupling is achieved by positioning one coil closer to the other by using a variable two-coil holder. However, the sketch shows a three-coil holder, i.e. one in which the centre coil is fixed in position and the two outer coils are varied in position with the central one. Next to the three-coil tuner is a single coil marked 'TA'. If the sketch show-

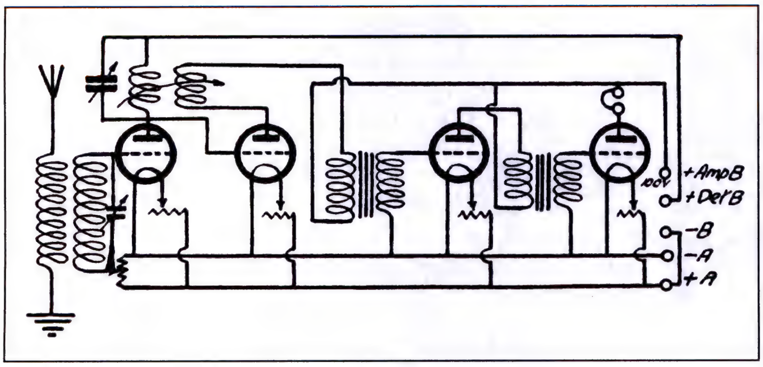


***Fig.1:*** *A tuned anode four-tube receiver described in the S.A. Wireless and Radio Weekly for August 26th 1925.*

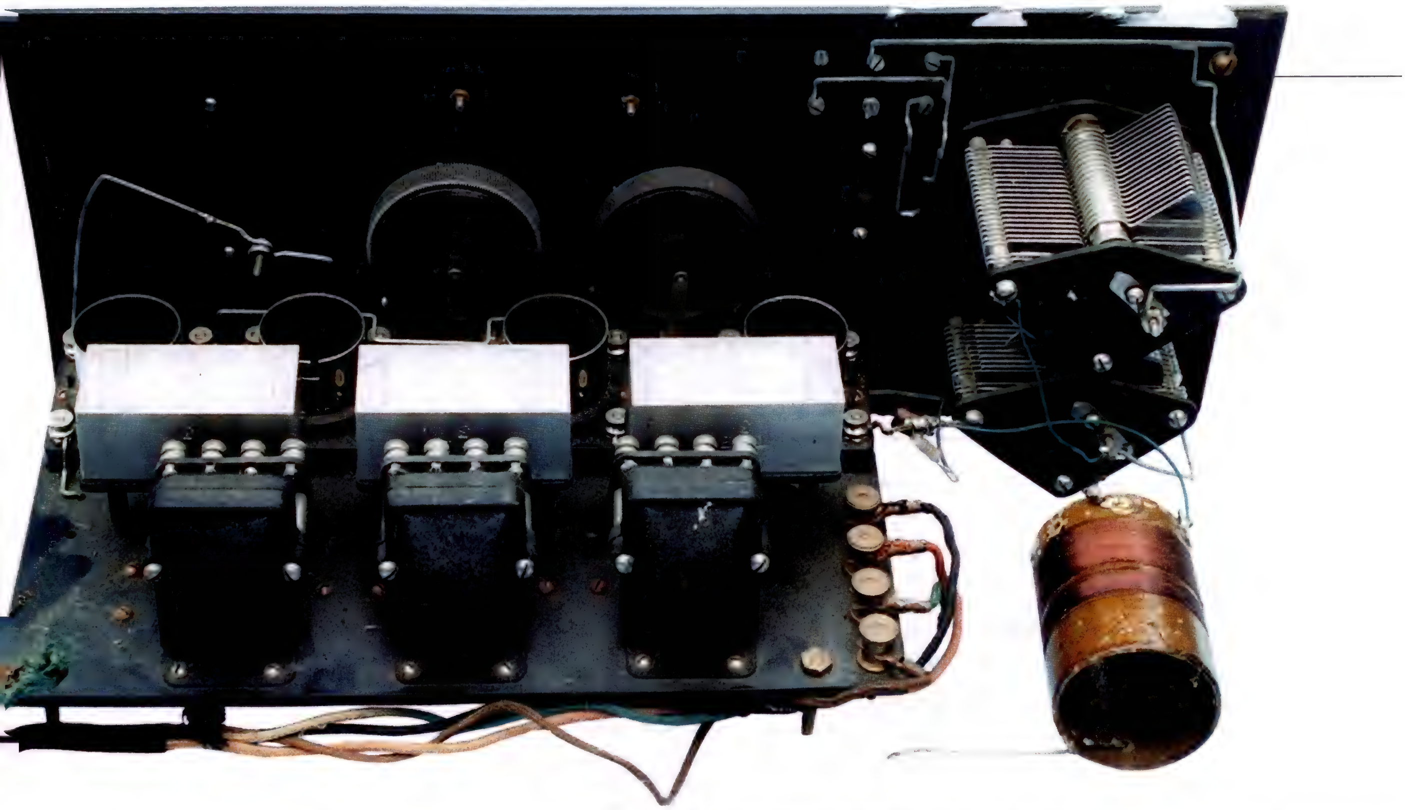


***Fig.2:*** *Inside an unusual four-valver sold by Adelaide firm Harland in the 1920s. There are no less than six audio transformers, and only one RF coil.*

ing the layout of the panel is to be believed, the coils are all along the same axis.

Does this mean that coupling between the antenna coil and the tuning coil (fixed in position) is varied, and then the other outer coil from the three-coil holder is varied to the stand-alone anode coil? If that is the case, one would think that it would have become a very effective tuned grid-tuned plate oscillator, with no hope of taming it!

Perhaps the secret lies in the judicious use of the rheostats in the filaments of the RF stages in particular, and the rheostat for the bias return of the grid in the RF stage. Whatever the explanation it must have worked well enough, for it was claimed that 3LO Melbourne could be separated from 5CL in Adelaide.

Other variants of anode tuning used solenoid coils, in which reaction was usually effected by a rotating 'tickler' coil inside the anode coil. The common features are that the two tuning circuits were in the grid and plate of the first valve, and detection took place in the second valve. Reaction was from the detector valve back across to the tuned anode coil of V1 and was adjusted by variable coupling. This is whether the duo-lateral coils in a two-coil holder were used, or solenoid coils with the tickler described above.

## Neutralised RF stage

The neutralised RF stage was also a popular circuit, and when combined with a regenerative detector it worked quite well. Neutralisation involved feeding a small amount of signal from the plate to the grid which was 180° out of phase with the grid, so that it 'neutralised' or cancelled out the signal already fed back from the plate to the grid via the inter-electrode capacity of the valve (Cg-p). By so doing, it prevented the tube from becoming a tuned grid-tuned plate oscillator.

Neutralisation could be provided in one of three ways. Firstly, the primary of the RF coil was centre tapped and the centre tap went to HT+. For RF this point was therefore at zero volts. One end of the primary went to the anode, and the other end was coupled via a small variable capacitor equal to the Cg-p of the valve. Each end of the primary was always 180° out of phase with the other – just like the centre-tapped secondary of a mains transformer.

It seems that this circuit was a little difficult to manage. In another popular method, a tapping is taken on the secondary or tuning section of the RF coil, and then fed back via the neutralisation capacitor. When these sets were presented for the home constructor, in the majority of cases no coil details were given for the set builder to wind. Instead, commercial varieties were specified as part of a kit. However, in case anyone is wondering, the tap was about 30% of the way along from the earthy end of the coil.

The third method of neutralising, which was adopted by some Astor models in the later 1920s, was simply to connect a neutralising capacitor from the detector stage tuning circuit to the RF stage grid.

The text describing the construction of a particular 1925 neutralised set has to be read to be believed. Valve type 201-A's are mentioned as a suitable valve for this receiver. Also mentioned are 'large' and 'small' tubes. (It is not known if a 201-A was

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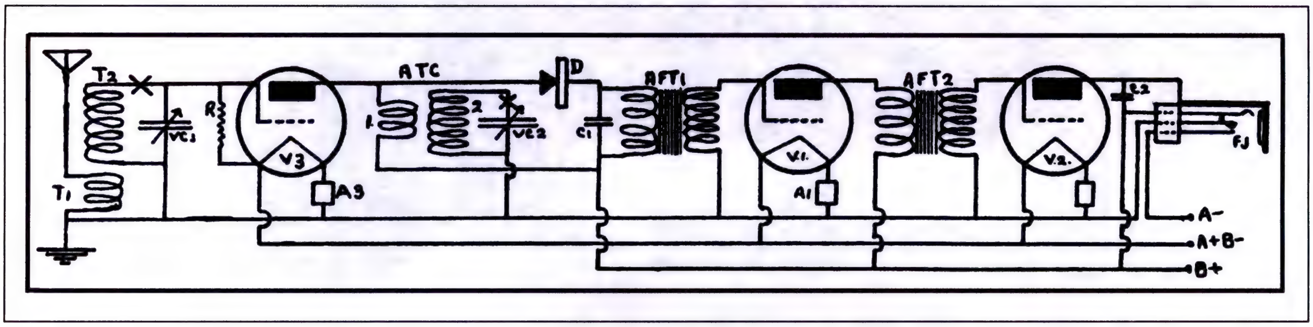


***Fig.3:*** *This is the kind of circuit configuration which may have been used in the Harland set, taken from The Listener In for February 13, 1926.*

regarded as a bigg'un or a littl'un.) But did you know that 'large' tubes have a better tone quality on strong signals, because 'this is due to loading in the small tubes, which makes the signal thin or scratchy'. Well, bless my soul. The things you find out!

## 'Harland' four valver

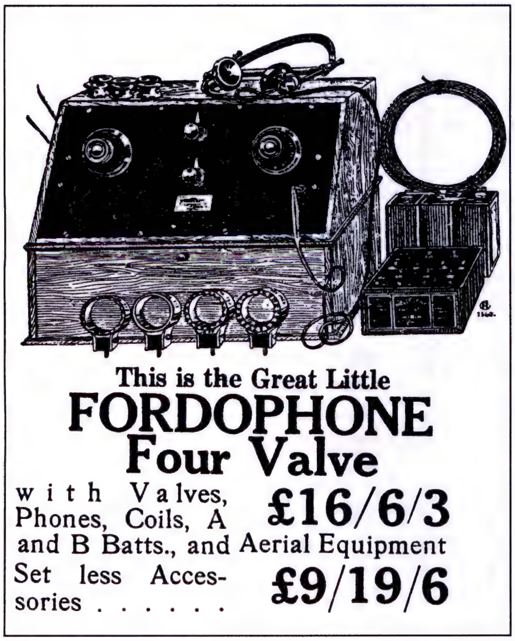
Harland Wireless Supplies of Gawler Place, Adelaide city, were one of a plethora of dealers-cum-builders who existed in the major cities in the mid 1920s. In the only example of their four-valve sets seen by the author (Fig.2), there are a few anomalies.

For example, and as you can see from the photo, there are two rows of three audio transformers. Not only that, but each set appears to be wired in parallel. They appear to be intact, and one 'set' has very low DC resistance for the windings (about 50 and 70 ohms per side).

Given that these peculiarities could be sorted out and explained in time, there remains the RF end. It does seem quite apparent that there are three stages of audio. So, what exactly was in the 'front end'?

There is evidence of great modifications here, but there are two tuning capacitors in place. The usual RF amplifier and detector configuration would not be possible with three stages of audio. If reflexing was a candidate, the RF amp would have to double up as an audio stage, but the fairly complex wiring suggests otherwise. All three audio stages are neatly in a row.

One possible explanation is the circuit of Fig.3, adapted for an extra stage of audio. Here we see a tuned RF amplifier, followed by a further tuning stage and a crystal detector, then followed by the audio stages. The text for this article (from *The Listener In* for February 13, 1926) goes on to say that crystal detectors in this situation are not nearly so 'touchy' as a detector in a crystal set.



This is the Great Little
FORDOPHONE
Four Valve
with Valves, Phones, Coils, A and B Batts., and Aerial Equipment £16/6/3
Set less Accessories . . . . . . £9/19/6

***Fig.4:*** *An advert for the 'Fordophone' four valve set, taken from The Listener In for December 26, 1925. There were many such advertisements in Australian magazines of the time.*

## Other circuits

Regular readers of this column will no doubt recall the 'Flat Dwellers' Four' described in the August 1998 issue. This four-valver used a loop antenna and a curious reaction system. Basically, there was only one tuned circuit; the loop antenna stage. The RF transformer was untuned and served merely to provide reaction. Not shown (along with the grid leak and the grid capacitor, which were also omitted) is the fact that the RF transformer is vario-coupled. In other words, a two-coil 'tuner' is required.

Just where the advantage of a fourth tube lies in this type of set is a bit blurred. Certainly V1 would offer some gain ahead of the detector. However, there would be no tuned RF gain to improve selectivity at the detector stage, resulting in only one regenerative tuned circuit. All this could arguably be achieved by a conventional three-tube set with regenerative detector.

One other way of achieving RF stability without neutralisation was that employed in the 'Marco Four' circuit reprinted in *The Best of Australia's Wireless Weekly in 1927*. This is quite a conventional circuit with a tuned RF stage and detector, variable capacitor reaction and two audio stages. In this circuit, the spacing, and hence coupling from the RF primary to the secondary was adjusted for best results. The RF primary was wound on a separate former to the secondary, and the two were placed lying down on the baseboard.

Once the optimum coupling was found, they were held in place by passing a piece of bakelite or panel material along the insides of the formers and then screwing it down to the base board to hold them in place. So much for losses!

## 'Commercial' brands

On thumbing through the Australian magazines of the 1925 to 1928 era, there's no shortage of four-valvers being offered by the department stores in the major cities. These radios were either unbranded, or had the stores' own brand names on them. Small dealers often made and sold this type of set also.

Just who made them for the department stores was anyone's guess, and where are they today? They are and were probably even then often regarded as 'home maders' and of little or no technical interest.

A typical example is shown in Fig.4, which is the advertisement for the 'Fordophone' four-valver from Melbourne dealer Norris & Skelley. ea

# INFORMATION **CENTRE**

BY PETER PHILLIPS

## Is it easy for someone to eavesdrop on your computer activities? Yes, unfortunately...

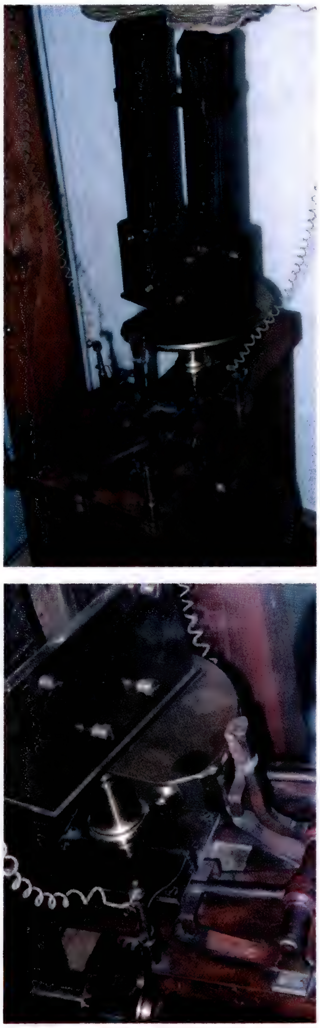
We cover quite a bit of territory this month, starting at 1832 with photos of the first ever DC generator, then to the present day with a discussion on how 'Tempest' radiation from your computer can be received and decoded by a remote eavesdropper. There's also discussion on sonic anemometers, bud lights and more.

**DURING 1998** I visited the Deutsches Museum in Munich, where I came across the Pixii DC generator, circa 1832, the first known device capable of converting mechanical energy to electrical energy. I described this generator late 1998, but the discussion got rather sidetracked when a reader asked about the relationship between the commutator and the rotating magnets. The ensuing discussion carried on for many issues, leaving the Pixii generator in a void.

However, EA's editor Graham Cattley has just returned from the very same museum, bringing with him a few photos of the Pixii device. You might recall that the generator does not have a rotary commutator, instead it has a set of large contacts operated by a cam fitted to the shaft. A few readers previously pointed out that a similar Pixii generator in a British museum does in fact have a rotary commutator, which is how the device is shown in old electrical books. This of course begs the question as to which example is the first. I suspect the Deutsches Museum holds the original.

Anyway, the point of all this is to present the photos Graham brought back. As you can see, a single cam follower rests against the cam on the main shaft. The result is a set of switched contacts that alternately redirect the output from the coil to the two terminal posts at the front of the machine. Whether this system works well enough for it to be useful is open to debate, but obviously Pixii was aware of the need to switch the alternating output to give a DC output, making him the first person to produce a working DC generator.

What I would like to know, is who developed the rotary commutator? According to various books, the commutator did not come about until long after the Pixii generator, but given that there's a Pixii generator in England with a rotary commutator, perhaps this information is incorrect.



***These photos*** *show the commutating arrangement on the Pixii generator held by the Deutsches Museum. The switched DC output is taken from the terminal posts at the front of the device.*

Getting back to today's technology, here's a topic that appears to be alive and well, despite my reservations about it when a reader (Greg Freame) first raised it in the May 2000 issue.

### Computer monitor surveillance

You might remember Greg's letter in May which in essence said that an internet site (**http://www.eskimo.com/~joelm/tempest.html**) claimed it was possible for others to pick up the radiation from your computer monitor to see what you are doing. According to this site: *"The general principle is that computer monitors and other devices give off electromagnetic radiation. With the right antenna and receiver, these emanations can be intercepted from a remote location, and redisplayed (in the case of a computer monitor), or recorded and replayed (such as with a printer or keyboard)."*

My reaction was sceptical, given the relatively weak strength of video information radiation compared to the radiation produced by the scanning circuitry of a monitor. However, it seems the technology does exist, to the point where considerable effort is needed in sensitive situations to prevent others picking up information via the radiation from a computer system. The first letter on this subject is from a reader who actually experienced this problem:

> *The item about reading a monitor display via its EM output has made me recall a situation in the late '80s when I was working for a small consultancy company (now defunct). This company had an ASIC design lab and one of its clients was a defence*

*organisation. Their requirements for the lab where the work was being done included a complete Faraday cage to mask the EM output from computer monitors so external monitoring could not be done. The message is 'never underestimate the capabilities of technology – particularly military technology.'*

*Oh yes, we also had to have curtains on all windows so the monitors couldn't be viewed optically either. When you think about it, the technology required to view monitors optically isn't really a lot less sensitive than that required to pick up the EM output.* (Geoff Field, Chelsea Heights, Vic)

Thanks for sharing this with us Geoff. Clearly the military takes such a situation seriously, but should we home users be concerned? The next letter on this topic is from a reader who also sent me an article by Cambridge University scientists discussing remote monitoring of computer electronic emissions, and ways to prevent this.

## Tempest radiation

*You may remember the equipment formerly used for detecting the operation of televisions when they had to be licensed. This is a crude ancestor of the monitoring now possible. It works, as I have seen it demonstrated. The enclosed article has an illustration of commercially available equipment for the purpose. You will note that the manufacturer of this equipment is based in Cheltenham (UK), home of the British GCHQ – no doubt a coincidence! The paper may be found at* ***www.cl.cam.ac.uk/~mgk25/ih98-tempest.pdf*** *should you wish to verify the source. You will also find the anti-tempest font technology in use in the PGP email security program.* (The Smoking Man, via email)

According to the article, the term 'Tempest' radiation (otherwise called compromising emanations) is a code word used by a US government program aimed at attacking the problem. The article runs to around 19 pages, so here's a few highlights, starting with the abstract:

*It is well known that eavesdroppers can reconstruct video screen content from radio frequency emanations. We discuss techniques that enable the software on a computer to control the electromagnetic radiation it transmits. This can be used for both attack and defence. To attack a system, malicious code can encode stolen information in the machine's RF emissions and optimise them for some combination of reception range, receiver cost and covertness. To defend a system, a trusted screen driver can display sensitive information using fonts which minimise the energy of these emissions.*

Regarding home users, the paper has this to say:

*"Electromagnetic radiation as a computer security risk was mentioned in the open literature as early as 1967. One of the first more detailed public descriptions of the Tempest threat appears to have been a 1983 report in Swedish, but the problem was brought to general attention by a 1985 paper in which van Eck demonstrated that the screen content of a video display unit could be re-constructed at a distance using low-cost home built equipment – a TV set whose sync pulse generators were replaced by manually controlled oscillators. His results were later confirmed by Moller, Bernstein and Kolberg, who also discuss various shielding techniques.*

*Smulders later showed that even shielded RS-232 cables can often be eavesdropped at a distance. Connection cables form resonant circuits consisting of the inductance of the cable and the capacitance between the device and ground. These are excited by the high-frequency components in the edges of the data signal, and the resulting short HF oscillations emit electromagnetic waves."*

And if you think computers are the only thing at risk, consider this:

*"It has also been suggested that an eavesdropper equipped with fairly simple radio equipment and standing near an automatic teller machine could pick up both magnetic stripe and PIN data, because card readers and keypads are typically connected to the CPU using serial links. A related risk is crosstalk between cables that run in parallel. For instance, the reconstruction of network data from telephone lines has been demonstrated where the phone cable ran parallel to the network cable for only two metres."*

We don't have the space to cover the entire document, which you can download from the internet site given above. The point is, it is indeed possible to pick up and decode information radiated by a computer, but it's also possible to get around the problem, as the paper explains. One method is to use Tempest fonts, as explained in the following (edited) extract:

*"Only the high frequency components of the video signal can be picked up by an eavesdropper. It turns out that if the top 30% of the horizontal frequency spectrum of text is filtered out, the user sees little difference, but it becomes invisible when picked up by an eavesdropper, even if the antenna is right next to the computer monitor."*

The paper concludes by making the point that *"the high cost of physical shielding and increasing clock frequencies in modern computers will ensure the problem will not go away quickly. Things will be made worse by the arrival of cheap software-based radios – universal receivers in which all signal demodulation after intermediate frequency conversion is done in software using high-speed DSPs. This technology will allow low-budget attackers to implement sophisticated Tempest attacks previously only possible with very expensive, dedicated equipment."*

My thanks to both contributors on this topic. It's sobering, especially the potential for things to get worse. On the other hand, despite the best equipment, a snooper is unlikely to be able to pick up your entire video screen, just the high frequency components. This might still provide enough information for someone who knows what you are doing, but for most of us, the threat is not likely to require a Faraday cage or other expensive preventative measures. However, knowing about the potential for eavesdropping, and better still knowing how to get around it is very useful. Downloading the Cambridge University document will give you more information on how to protect your privacy.

## Sonic anemometry

In July a reader (John Hill, Island Bay, NZ) wrote about an idea he had to measure wind speed, in the process mentioning a sonic anemometer. I could find nothing about such a device, so I asked our readership for more information. There could be more letters coming, but here's one from a reader who recalls such a device.

> *Around 1982 my wife and I sailed our yacht from Darwin to Pt Lincoln via the west coast, causing me to develop an interest in navigation instruments that have good weatherproofing and no moving parts.*
>
> *I subsequently found a project for a DIY sonic anemometer in Wireless World, probably around 1981-82. I can't find the article, but from memory it had four pairs of ultrasonic transducers supported on cross arms at right angles, so each transmitter was about one metre from its receiver.*
>
> *My memory is a little hazy, but as I recall, the transmission time for an ultrasonic pulse for each of the Tx/Rx pairs is measured, allowing a vector for the wind speed and direction to be derived. Air temperature is also derived from these times to allow for compensation. The transceiver electronics are relatively straightforward, but obviously much is handled by algorithms in the microcontroller.* (Tony Jones, email)

Tony also included a diagram, which is reproduced in Fig.1. It's interesting that while I could find nothing about a commercial sonic anemometer, there are DIY projects available. Still, I'm sure we've not heard the last on this topic. Perhaps, I hear you saying, there's a project idea for *EA*! I welcome any further information about commercial sonic anemometers, or more about DIY versions.

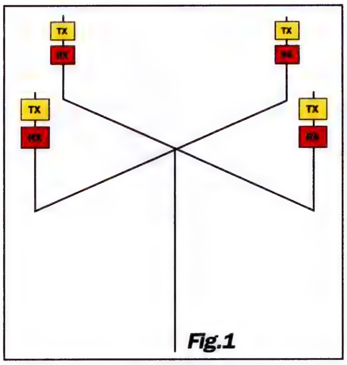


Fig.1

**Fig.1:** *The overall construction of a sonic anemometer described in an '80s Wireless World DIY project. Each arm is about one metre long.*

## ATX motherboard in a car

The following question was sent by email. I should be able to answer it, but without researching the market, I can't, so perhaps a reader can help:

> *I was looking at your magazine recently and noticed you have a Question and Answer section, so here goes. I wonder if you can tell me if there are manufacturers of power supplies that do DC/DC conversion to run an ATX motherboard in a car. That means 12V input, with outputs of -/+ 12V, -/+5V and 3.3V. The power supply capacity should be 65 watts. Can you help by pointing me in the right direction, or giving information on building one.* (Kervin, email)

Off the top of my head Kervin, I don't know of such a supply. Certainly there are DC-DC supplies out there, but many of these require an input of 48V DC. So, all I can do is ask our readership. I don't recommend trying to build one, unless you are well versed in switching regulators. Another way that comes to mind is to use a 12V DC to 240V AC inverter, which then supplies a conventional IBM style power supply to power the motherboard. We presented a 300VA inverter in October '99 which would do the job. It's available as a short form kit from Oatley Electronics for around $90 (phone (02) 9584 3563).

## Bud lamp blowouts

In May a reader (Bill Van Ommen) asked about methods of finding a blown bud light, given that these are often arranged as a number of series strings in parallel. That is, if one blows, all lights in that string go out. The following letter presents an idea, that while perhaps a bit difficult to implement, would certainly eliminate the problem.

> *Regarding finding a blown bud light, I suggest fitting a pair of back to back zeners (in series with each other), or perhaps a low voltage VDR, across each lamp. Then, if one lamp in a string should blow, the Zeners or VDR across that lamp will maintain continuity. The remaining lamps will still light, and the culprit is the one that doesn't light.*
>
> *I suggest that the Zener diodes or VDR have a voltage rating of about 150% and a wattage rating of about 200% that of each lamp. It's essential that the combined DC voltage rating of these devices be at least 10% to 20% higher than the peak voltage (340V) of the mains.* (Herman Nacinovich, Gulgong, NSW)

Thanks for this suggestion Herman. As I recall, this principle was used in the days of series street lighting, although I guess the device across each lamp was neither a Zener or a VDR (as we know them today), as it simply shorted out, giving an increased voltage across the remaining lamps. Using Zeners or VDRs would not cause this effect, but it might be a soldering nightmare to fit these devices across every lamp.

However, once done, you'd have a set of bud lamps that would last forever, as lamp replacement would be easy. Regarding voltage and wattage rating, I agree with Herman that the combined voltage rating of all Zeners (or VDRs) in a series string should exceed the supply voltage, although this is often only 24V AC. That is, the Zeners (or VDRs) should not offer a current path themselves. So, if each lamp is rated at say 2.4V, the zener voltage should be 4V or so. If each

*(continued on page 95)*

ELECTRONICS TECHNICIAN

We have a vacancy in our workshop for an Electronics Technician with a relevant trade certificate, diploma or associate diploma, who has a comprehensive understanding of basic analog electronics, experience in analog design, power or audio and who enjoys faultfinding.

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BY OWEN BISHOP

# Touch switch

You can turn on almost any electrical device with this switch, and the switch automatically turns it off a short time later. Use it for lighting a dark corridor, a porch lamp, a light in a dark cupboard, or a bedside lamp. You can use it to switch on a portable radio or tape player when you go to bed, and have it switch off automatically after you have fallen asleep (provided that you don't take too long about it!).

**PARTS LIST**

| | |
|---|---|
| **● resistors** | |
| (carbon or metal film, 0.25W) | |
| R1 | 10k (see text) |
| R2 | 18k |
| **● capacitors** | |
| C1 | 470uF, electrolytic (see text) |
| C2 | 100pF ceramic (optional, see text) |
| **● semiconductors** | |
| IC1 | 555 timer IC |
| Q1 | BC548 or equivalent |
| **● miscellaneous** | |
| RLA1 | Relay, for 6V or 9V operation, SPST or changeover, with suitably rated contacts. |

Stripboard, 32 mm x 81 mm (12 strips x 31 holes), 6 x 1mm terminal pins, 8-pin IC socket, material for touch plate, battery holder or mains adapter.

**THE DEVICE** uses a relay to do the switching, and the type used in this project is rated to switch up to 240V AC. So the switch can be used to control equipment that runs on AC as well as DC. Other types of touch switch often use a transistor for the switching, which makes them unsuitable for AC.

Although this circuit *can* be used for switching mains voltages, we do not recommend readers to use the touch switch in this way unless they have had previous experience of building projects that involve the mains. There is plenty that can be done safely at low voltages, and there is often a way round the mains voltage problem. For example, if you want to control a string of fairy lights, insert the touch switch on the low-voltage side (often 24V) of the transformer.

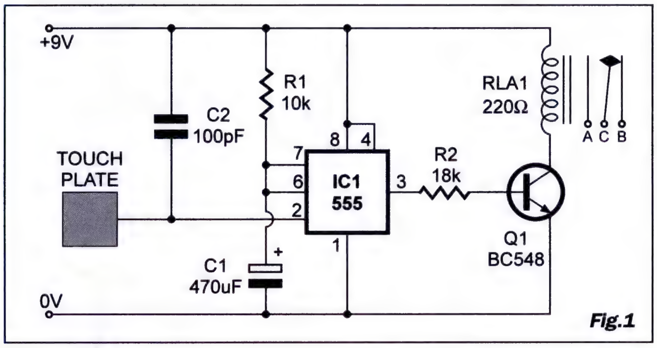


*Fig.1*

## How it works

Once again, the circuit is based on the 555 timer IC (Fig.1). This IC has so many uses, some of them nothing to do with timing, that we should wonder how we ever managed without it. This time we make use of the high sensitivity of its trigger input. In this project, the IC is connected as a pulse generator. The full technical name for this is *monostable multivibrator*, which is usually shortened to *monostable*; the 'mono' part of its name give the clue to how it acts – it produces just one pulse when it is triggered.

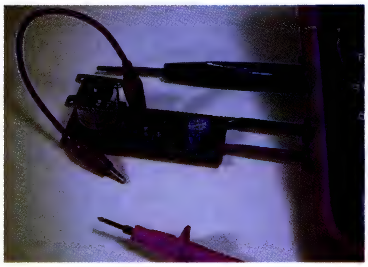
When the power is first switched on, current flows through R1 and charges C1 until the voltage across C1 equals one third of the supply voltage. In this circuit, the capacitor is charged to exactly 3V. At this point an pins 7 and 1 are shorted together by an internal transistor, which allows current to flow through R1 to the 0V line. Nothing more happens then until the IC is triggered. This is done by providing a low voltage input to pin 2, the trigger input.

When this happens, the internal transistor turns off, and the flow through from pin 7 to pin 1 is stopped, so the charge on C3 begins to build up. At the same time, the voltage at the output, pin 3, which has been zero all this time, rises almost instantly to 9V. This is the beginning of the output pulse. Charging continues until the voltage across C3 reaches two thirds of the supply voltage (6V in this case).

As soon as the voltage reaches two thirds of the supply, two things happen. The output voltage drops almost instantly to zero, ending the pulse. The other thing that happens is that the internal transistor tuns back on again, and the path between pins 7 and 1 opens up again – so that C1 is rapidly discharged. However, it does not discharge completely. It discharges until the voltage across C1 is equal to one third of the supply. Then the transistor turns off, and the timer is ready to be triggered again.

The trigger input, pin 2, is normally held at the positive rail (9V) by the internal circuit of the IC. It is connected to the input of a very sensitive comparator, which triggers the timer when its voltage is brought below one third of the supply voltage. Touching the pin with a finger is enough to cause the timer to be triggered, and when this happens the pin 3 output goes high and turns on Q1. Current then flows through Q1, and energises the coil of the changeover relay.

This means that by choosing the appropriate pair of contacts on the relay, we can switch some-



***Shown here** being tested, the Touch Switch can be made to control just about anything. Well, anything electronic, anyway...*

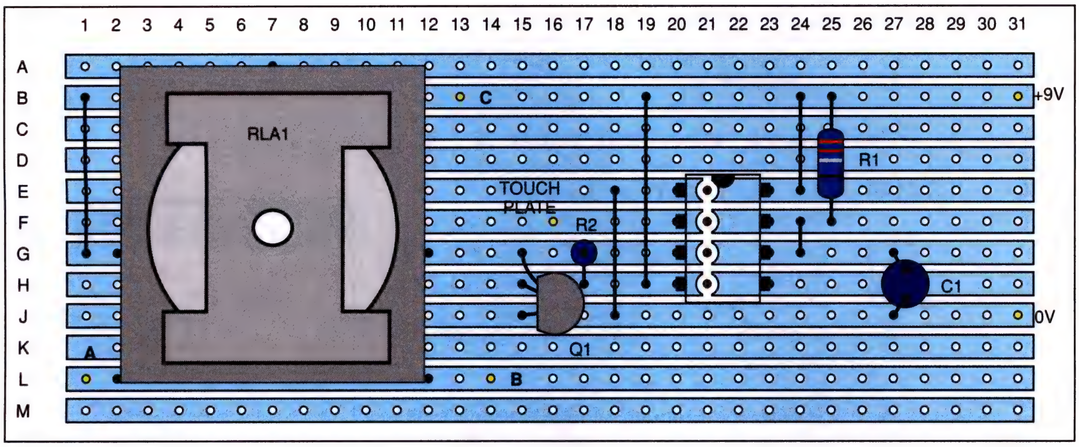


***Fig.2:*** *It's a big board with only a few components. You'll have to cut the tracks under the relay to suit the particular model you have – it seems that they're all different...*

thing on or switch something off simply by touching the touch plate. An example of switching off is a mute switch on an audio system – the touch switch could be wired into the speaker lead. We could also switch one device on and another one off at the same time, simply by using both sets of contact on the relay.

Switching battery-powered equipment such as radios is easily done by making a 'battery sandwich'

from two small scraps of metal and a square of card of plastic (Fig. 3), or by using a small square of double-sided circuit board. Switch on the radio by its own switch, then leave it ready for the touch switch to complete the circuit later.

## Touch plate

The trigger input is exceedingly sensitive to being touched. The timer is triggered if the voltage at pin 2 falls below one third of supply for even a few microseconds, and once triggered, it can not be triggered again until the pulse has ended. Normally a lead of narrow-gauge wire is run from the timer to a metal touch plate. This plate is typically about 2cm square, but plates of other sizes and shapes are available from some suppliers.

If you can't find one to buy, it is easy to make your own. Any small scrap of metal sheet can be pressed into service, and need not be as large as 2cm square. In fact when we were testing the switch (see photo) it was sufficient to touch just the exposed jaws of the crocodile clip. In the past we have used a thumbtack (drawing pin) with the end of the lead wrapped round the pin and the tack pushed into a strip of wood or other insulating material. The main point is the plate must be insulated from ground. Then, when it is touched by a person whose potential is fairly close to ground, the fall in voltage triggers the circuit.

In some applications you may want to make a really big, touch plate. This is a good idea for a switch that is to be operated in darkness, such as a corridor light. Another point to note is that there does not have to be actual contact between your finger and the touch plate. The plate may be covered by a thin layer of insulating material, such as plastic sheet, or PVC insulating tape. This allows you to protect the plate against corrosion, or just to make the touch plate more decorative.

Usually the lead between the circuit board and the touch plate will be only a few centimetres long, but there may be projects for which you would like a longer lead. We have tested the circuit with a lead 5m long and found that it works just as well. The only problem is that the lead acts as an antenna and picks up EMI (Electro Magnetic Interference).

This comes mostly from the mains wiring of the house; If someone switches some mains lights, or worse, a motor such as the compressor motor of a refrigerator is being switched, this causes voltage spikes in the lead of the touch plate. These are likely to turn the switch on at the wrong times. We have found that a *small* disc ceramic plate capacitor connected as C2 in Fig.1 will damp out the spikes caused by EMI without interfering with the touch action, but you may need to experiment with this when setting up the circuit.

If there is a lot of interference in the region of the switch, you may need to increase the value of C2. On the other hand, this will make the circuit less responsive to your touch. In most circumstances and with a relatively short lead you will not need C2 at all.

Another solution to the EMI problem is to use a light-duty shielded cable for the lead. Connect the shield at one end only to the 0V line of the circuit. Connect the core to the plate at one end and to pin 2 at the other. This solution is more expensive than the capacitor, especially if the lead is several metres long.

*(Continued on page 95)*

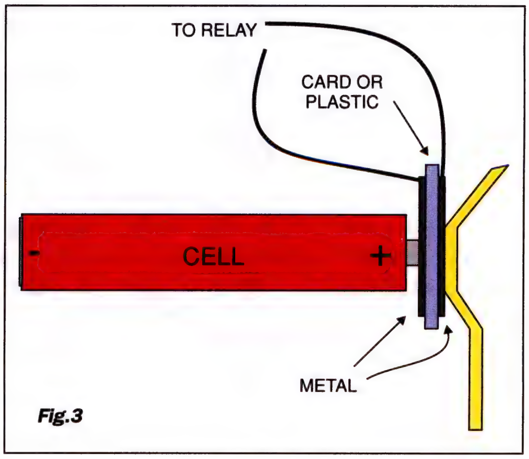


***Fig.3***

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# $10 WONDERS

BY OWEN BISHOP

(Continued from page 93)

## Timing

The output pulse is high for as long as C1 is charging from one third of the supply voltage to two thirds of the supply. This time depends only on the values of C1 and R1, and (surprisingly) doesn't depend on the value of the supply voltage itself. This is one of the reasons that the 555 is so popular as an accurate timer. The equation for the time of a single pulse is: **t = 1.1RC**

In Fig. 1, R = 10000 and C = 0.00047, so t = 5.17 seconds, which could be long enough for a porch or corridor light. Both R and C may be increased if you want longer periods. The maximum practicable value for R is 20M. Wire two 10M resistors in series to obtain this.

A period of one hour is obtained by making R1 = 3.3 M and C1 = 1000uF. This is about the longest period obtainable because electrolytic capacitors have higher leakage currents that other types. With a large-value capacitor and a very small charging current, the charge may leak away almost as fast as it accumulates. In any case, the time is likely to be longer than that estimated by the calculation.

If you really must use a large-value electrolytic, choose one which has a working voltage higher than the supply voltage of the circuit. Its leakage is less if the capacitor is being under-run. Also remember that the capacitance of a new electrolytic capacitor increases with use, and decreases with disuse, so do not expect timings to be spot-on with electrolytics.

## Construction

Before building the circuit decide on the maximum voltage and current that you will want the device to switch. Then make sure to purchase a relay rated to these values. The actual resistance of the coil does not normally matter too much. Most have a resistance of a few hundred ohms. Some coils are intended for a 12V supply, some for other voltages. They usually work just as well on slightly different voltages. For instance the relay in the prototype is rated to work on 6V, and has a coil resistance of 410Ω, but works well on 9V. For preference, though, select a relay to run on 9V with a coil resistance of a few hundred ohms.

The layout of the construction board depends on the arrangement of the contacts on the particular relay that you are using. Examine it carefully (there may be a pinout diagram on the package) and identify the pair of pins for the coil. Then find the contact pins. In a changeover relay there is a common pin (C in Fig.1), a normally closed contact (A) and a normally open contact (B). If a device is to be turned ON by the switch, use pins B and C.

Once the relay wiring has been worked out, the circuit presents few constructional problems. Note where the copper strips are cut in the region of Q1. In addition, that strips are cut where it is necessary to separate the terminals of the relay. Positions may be different from those shown in Fig.2.

The circuit takes 4mA to run on stand-by, when the relay is not energised so it is suitable for battery operation. However, if it is intended for the relay to be on for long periods it would be better to use a plugpack to provide power for the switch and for the lamp or other device that it is switching. **ea**

# INFORMATION CENTRE

BY PETER PHILLIPS

(Continued from page 91)

## What??

We seem to be having a run of logic type questions, although this one has a practical application for many EA readers. It was sent in by John Wiltshire (via email) who was given the question by a colleague (Michael Harris):

A two-storey house has three downstairs light switches that control three upstairs lights that are not visible from downstairs. By leaving only one light switched on, and going upstairs only once, how can you work out which switch controls which light?

## Answer to July

The year is 2000, parents married in 1960, brother born in 1964. However, and here's the logic bit, parents divorced in 1985 and remarried each other in 1990. That is, they were married for 25 years, divorced for five years, then married for another 10 years. So the total time parents were married is 35 years, explaining why they have a 36 year old son who was not born out of wedlock. **ea**

# WEB WATCH

BY DARREN YATES

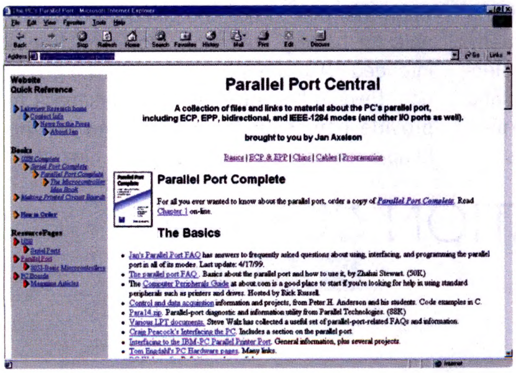
# Bombs & Boffins

@ **ONE OF THE EASIEST** ways to interface your PC to the real world is to use the parallel port. Intel and Microsoft look hell-bent on getting rid of it but with its bi-directional 8-bit parallel data lines, it's a simple easy way to control external devices without having to buy an expansion port card.

If you need info on pinouts, how to program it etc, head over to Parallel Port Central **www.lvr.com/parport.htm**. Here you'll find everything you need to know about programming, device drivers, even how to program the port from Linux. Definitely one to book in your favourites collection.

@ **ELECTRONICS HAS** given way to computers for most of Australia's young people – good money, easy to use and you don't have to get your hands dirty. Pity. We still need the next generation to understand electronic principles or else we'll be in big trouble.

Ok, enough of the soap box. If you're working with kids as a teacher or even wanting to have some fun with your kids that doesn't involve a television screen, head over to The Science Club **www.halcyon.com/sciclub/kidproj1.html** This page has a number of fun projects to get kids involved, that show physics and electronics in action – such as building an electrostatic motor from soft drink bottles, or constructing a simple telescope.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## Parallel Port Central

A collection of files and links to material about the PC's parallel port, including ECP, EPP, bidirectional, and IEEE-1284 modes (and other I/O ports as well).

brought to you by Jan Axelson

Basics | ECP & EPP | Chips | Cables | Programming

### Parallel Port Complete

For all you ever wanted to know about the parallel port, order a copy of *Parallel Port Complete*. Read Chapter 1 on-line.

### The Basics

- Jan's Parallel Port FAQ has answers to frequently asked questions about using, interfacing, and programming the parallel port in all of its modes. Last update: 4/17/99.
- The parallel port FAQ. Basics about the parallel port and how to use it, by Zhahai Stewart. (50K)
- The Computer Peripherals Guide at about.com is a good place to start if you're looking for help in using standard peripherals such as printers and drives. Hosted by Rick Russell.
- Control and data acquisition information and projects, from Peter H. Anderson and his students. Code examples in C.
- Para14.zip. Parallel-port diagnostic and information utility from Parallel Technologies. (88K)
- Various LPT documents. Steve Walz has collected a useful set of parallel-port-related FAQs and information.
- Craig Peacock's Interfacing the PC. Includes a section on the parallel port.
- Interfacing to the IBM-PC Parallel Printer Port. General information, plus several projects.
- Tom Engdahl's PC Hardware pages. Many links.

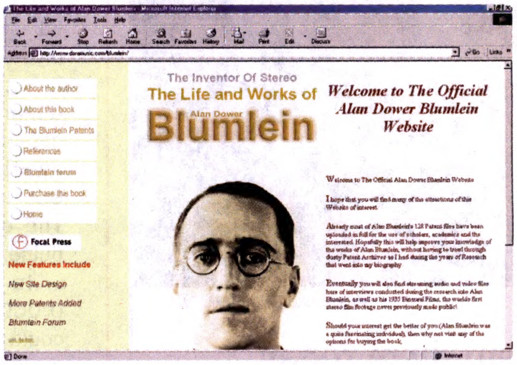
@ **THE 20TH CENTURY** saw man invent some shocking technologies, but we also managed to come up with some nifty ideas that didn't involve blowing each other up. If technical history interests you, take a look at this page on Recording Technology History at **http://history.acusd.edu/gen/recording/notes.html**.

It includes plenty of links to other more in-depth stories but gives you a time-line about various important milestones in man's attempt to record both audio and video on various media. But be warned – reading this through and following the links is an easy way to lose a couple of hours. A great read though.

@ **WHILE ON THE SUBJECT** of history, there's finally been a book written about the life and work of Alan Dower Blumlein, one of last century's great boffins who died before his time in a plane crash in 1942 at only 39 years of age.

He not only sorted out the stereo sound recording system we enjoy today by the time he was 28, but he also made major contributions to electronics television before WWII. Blumlein had 128 patents attributed to him and a web site devoted to the book 'The Life and Works of Alan Dower Blumlein' (*reviewed in last month's issue – Ed*) has been set up that includes the text of almost all of those patents.

Blumlein's name has never been far from controversy; from the time of his death when British authorities kept his death a secret lest the Germans found out Britain's great loss, to the 30-year fight to get Blumlein's story told which only seem to end when the original biographer, Francis Thompson, died in 1998. Head over to **www.doramusic.com/blumlein.**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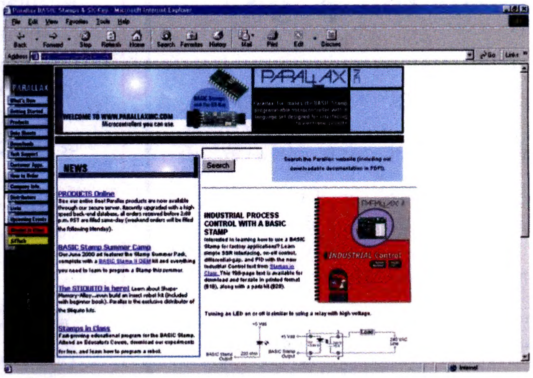
I hope that you will find many of the attractions of this Website of interest.

Already most of Alan Blumlein's 128 Patent files have been uploaded in full for the use of scholars, academics and the interested. Hopefully this will help improve your knowledge of the works of Alan Blumlein, without having to trawl through dusty Patent Archives as I had during the years of Research that went into my biography.

Eventually you will also find streaming audio and video files here of interviews conducted during the research into Alan Blumlein, as well as his 1935 Binaural Films, the worlds first stereo film footage never previously made public!

Should your interest get the better of you (Alan Blumlein was a quite fascinating individual), then why not visit any of the options for buying the book.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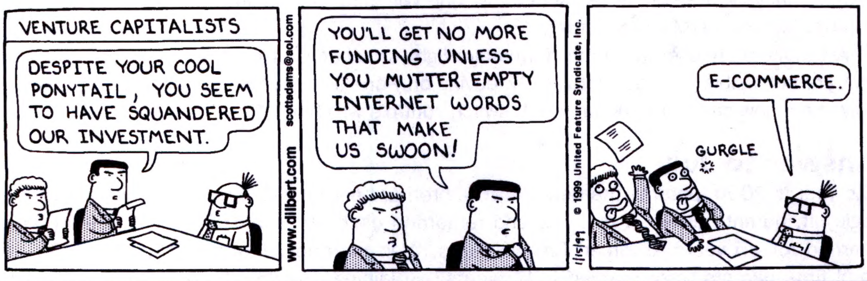
Turning an LED on or off is similar to using a relay with high voltage.

@ **MICROCONTROLLERS** – they're everywhere. It seems you can't move around the web and trawl for electronics sites without bumping into a few microcontroller pages along the way.

Parallax was one of the first vendors out with an easy to use controller that ran a modified version of BASIC. Most serious techheads will turn their nose up at BASIC but I'm happy to put my hand up and say I think it's great. If you've never thought about using a microcontroller and you want something that's not too difficult to use, the BASIC Stamp chip could be a good option. This site **www.parallaxinc.com** is the home page for Parallax and has all the info plus downloads as well. **ea**

**DILBERT**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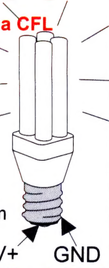

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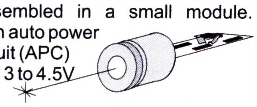

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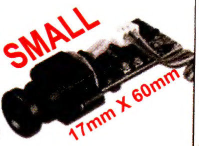

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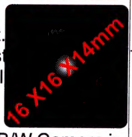

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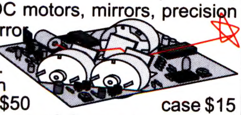
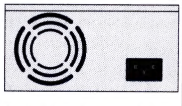
**20ADC motor speed controller kit (K98)** when purchased with the above motor $14

**AUTOMATIC LASER LIGHT SHOW KIT: MKIII.** Changes patterns every 5 - 60 secs. Countless great displays from single to multiple flowers, collapsing circles, rotating single & multi ellipses, stars, etc. Kit inc. PCB, all on board comp-onents, three small DC motors, mirrors, precision adjustable mirror mounts & laser module. (K115) Kit with laser module $50 case $15 a special for August & September 1995.



**(NEW) ProLine PS/2 MOUSE:** Ergonomically shaped for comfort. Supports plug & play. 600dpi. Comes in its original box. A free mouse pad is supplied with every mouse: $10

**ATX PC POWER SUPPLY:** These NEW 90W LITEON Brand power supplies include logic level controlled mains switch and have the following outputs +5V @ 10A, -12V @ 0.2A, +12V @ 1.5A, +3.3V @ 6A. Input is 100-240V AC @ 50-60Hz via an IEC socket. Has internal fan. Unit weighs 1.3kg and measures 140 x 150 x 85mm: (PATX1) $15



**WE HAVE FRESH STOCKS OF NEW 12V / 7Ah GEL BATTERIES**

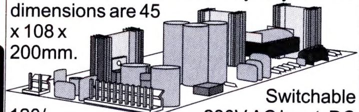
Priced at a fraction of their real value. 65mm X 150mm X 94mm, with suitable trickle charger. $25

**ELECTROLYTIC CAP BARGAIN**

Quality brand ideal for power supply projects. 3300uF 25V 32mm X 16mm, 7mm lead spacing. $1ea or 10 for $7

**COMPUTER POWER SUPPLY:**

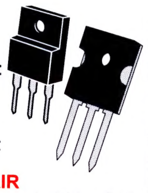
New complete PCB assembly only. Overall dimensions are 45 x 108 x 200mm. Switchable 120/230V AC input. DC outputs are +5V@6A, +12V@1A, -12V@1A, -5V@1A. Circuit provided, RU approval. Modern design. Mains input - Not for the inexperienced ! Be quick: (PS6) 4 for $24



**MOSFETS:**

IRFZ44: 60V / 50A (N channel, TO-220), 0.028ohm on resistance: $2.50 each

IRF540: 100V / 28A (N channel, TO-220), 0.077ohm on resistance: $2.50 each



**POPULAR MOSFET PAIR**

MTP3055 & MTP2955 any mix 10 for $10

**SPECIAL BARGAIN LABTEC PLUG PACK** 15VDC @ 1A Well made. Has UK plug easily replaced Special price $12

**PHONE CALL SCREENER / DTMF DECODER KIT:** Ref. EA February 2000. With the an Answering Machine & this kit you can build a phone Call Screener, a Remote Operated Relay via the phone or a Keyless / Keypadless DTMF Alarm Switch. This kit does not connect to the phone line, it uses an Electret Microphone (mains ents, Electret Microphone, plastic box, pushbutton, plugpack, label and a speaker: (K153C) $42

**OVERSPEED MONITOR KIT:**

Ref EA Feb. 97.Gives a pulsed tone signal when preset speed is exceeded. Speed is set by a pot-entiometer: travel at the desired speed and adjust pot until tone is heard, then mark pot position for future reference. Requires two conn-ections to vehicle: +12V and ground. A small PCB is provided for a Hall Effect pick-up sensor. This assembly is mounted near the drive shaft and connected to the main PCB by three wires. Kit includes two PCBs and all on-board components, a small speaker, and even two small powerful 'rare earth' magnets: (K099) $22

# SUPER SPECIAL AUGUST / SEPTEMBER PRICES

**MOST OF THE PRICES IN THIS AD ARE SPECIAL PRICES FOR THE MONTHS OF AUGUST AND SEPTEMBER ONLY. PLEASE QUOTE THESE PRICES WHEN ORDERING**

**KEYCHAIN LASER POINTER 650nm:** Supplied in a small metal cylindrical case that is fitted with a key-chain. Powered by 3 LR44 cells (supplied):(LPM2) $11

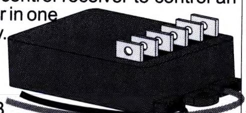
**(NEW) PACKARD BELL KEYBOARD:** Standard 105-key Keyboard with a blue colour coded PS/2 plug. New & in original packaging. Weight is approximately 1.3kg: (099969) $12

**ALSO WINDOWS KEYBOARDS AVAILABLE, NEW BUT DUSTY** $12

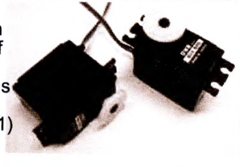
**VIDEO CAMERAS**
**CCD B/W CAMERA IN SWIVEL CASE**
**$99**

**PCB VIDEO CAMERAS**
**B/W CCD CAMERAS $89**
pinhole (60deg.), 92 deg, 120 deg.
add $10 for 150 deg.

**200A R/C MODEL SPEED CONTROLLER KIT:** This kit is designed to work direct from a standard 1-2ms pulse from a radio control receiver to control an electric motor in one direction only. Features include a brake. Kit includes PCB and all on-board components including 5 high power mosfets and a small (26 x 64 x 38mm) case: (K152) $35



**RADIO CONTROL MODEL SERVO:** These servos are ideal for robotics projects with good speed and high torque specifications. Servos measure 55mm long x 20mm wide x 38mm high. Used in our Robotic Arm and Servo Controller kits. Servos are supplied with a selection of output arms and disks plus mounting screws (MS1) $22 each



**PAN / TILT DUAL SERVO CONTROLLER KIT:** Ref. SC Jan 1998. This kit can be used to control two model radio control servos such as our MS1 servos. Two servos can be configured to rotate & pan a small camera (these parts are not included in kit). PCB measures 63 x 48mm and operates from 9-12V DC. The kit includes a PCB, all the on-board components, pushbutton, potentiometers, knobs, plastic case & a label: (K114) $19

**2 MOTOR LASER LIGHT SHOW KIT**

Kit includes very bright laser module, all electronic components, two high quality motors plus front surfaced mirrors. The other thing required is a little bit of skill for the assembly. Simple construction with no PCB required. $20

**Check out our "new look" web site for more products. Amazing cheap super bargains in our bargain corner.**

# IMPORTANT NOTICE

# STOP PRESS

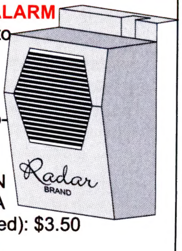
## CHEAP PENTIUM UPGRADES & MORE

Be quick to find the following & many more items in the "BARGAIN CORNER" of our website ....... SIMPLY SPEAKING VOICE SOFTWARE plus headset: $25, PENTIUM NOTEBOOK COMPUTERS: $700, PENTIUM MOTHERBOARDS: $90, PENTIUM 11 COOLER FANS: $3, TV/FM/CAPTURE CARDS with infra red remote controls: $160, TEKRAM SCSI CONTROLLERS: $90, POWERWARE 3115 300VA UPS's: $220, NET 450VA UPS's: $300, VGA CABLES: $3, TELEPHONY COMBO 33.6K MODEM CARDS: $35, 5V/3A SWITCHED MODE REGULATED POWER ADAPTORS: $12, SCANNER ASSSEMBLY with electronics /lens /mirrors: $12, etc., etc. VISIT:

**www.oatleyelectronics.com**

**DOOR / WINDOW ALARM**

Small, simple, easy to mount, operates when a door or window is opened, has very loud electro-mechanical siren, mounting screws provided, has OF-ON switch, needs 2 X AA batteries (Not provided): $3.50

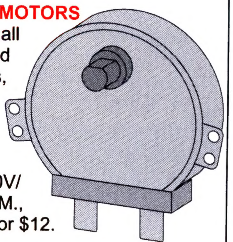


**STEPPER MOTORS**

SANYO DENKI (Step Syn) Type 103-770-6942, 4wire, main body is 67mm diam. by 51mm long, 1.5A / 4.5V, 1.8deg. steps, 0.46KG,: $15

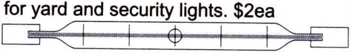
**GEARED AC MOTORS**

Brand new small mains operated geared motors, very strong, made for rotating microwave turntables, 240V/ 50Hz/3W/5RPM., $4Ea. or or 4 for $12.

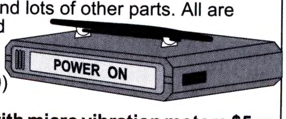


**NEW 500W Tungsten Halogen Lamps**

(All are new but packing may be shop soiled) Ideal replacement or spare bulbs for yard and security lights. $2ea



**(USED) POCKET PAGERS:** Small modern pagers, brands include LINK, PHILIPS, RTC. Condition "unknown", all have two small (grain of wheat) 1.5V lamps and lots of other parts. All are powered by one AA cell. (089910) 5 for $5



**Some with micro vibration motors $5ea**

**MASTHEAD AMPLIFIER KIT SPECIAL**

The MAR-6 available separately $4. The amplifier gives good results with any two metal wires or strips acting for the antenna. It should even work with a coat-hanger! Basic kit with both the PCBs & all on-board parts (K03) $15 ...Basic Kit + 2 Weather-proof Plastic Boxes + plug-pack: $24

**(ask for your free case with this item)**

**Some of our prices have changed as a result of GST & some as a result of the poor performance of the Australian dollar...**

**www.oatleyelectronics.com** Orders: Ph ( 02 ) 9584 3563 or 64, Fax 9584 3561, sales@oatleyelectronics.com, PO Box 89 Oatley NSW 2223
*major cards with ph. & fax orders, Post & Pack typically $7 Prices subject to change without notice* ACN 068 740 081 ABN18068 740 081

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